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Hearing Impairment and Elderly People

Background Paper

CONGRESS OF THE UNITED STATES
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Preface

Hearing impairment is very common among elderly people and can seriously affect their quality of life, personal safety, and ability to function independently. This OTA background paper discusses the prevalence of hearing impairment and its impact on elderly people; hearing devices and services that may benefit them; and problems in the service delivery system that limit access to these devices and services.

This background paper is part of the OTA assessment of *Technology and Aging in America* that was requested by the Senate Special Committee on Aging and the House Select Committee on Aging, and endorsed by the House Committee on Education and Labor. For that assessment OTA selected five chronic conditions for in-depth analysis because of their prevalence and severe impact on elderly people and because of the potential role of technology in their treatment. Hearing impairment is one of these conditions; the others are dementia, urinary incontinence, osteoarthritis, and osteoporosis.

Many of the chronic conditions that affect elderly people, including the types of hearing impairment that are most common, cannot be cured with available medical and surgical treatments. As a result, some elderly people, their families, and others assume that these conditions are not treatable. Yet assistive technologies can often help to maintain functioning even when the underlying disease or condition cannot be cured. In the case of hearing impairment, these technologies include hearing aids, infrared and FM assistive listening devices, telephone amplification devices and other telecommunication systems, signaling and alarm devices, and environmental design and aural rehabilitation techniques. Used singly or in combination, these technologies can facilitate communication and help to maintain an independent lifestyle for many hearing impaired people.

As more and more Americans live to older ages, the prevalence of chronic conditions that cause functional impairment is expected to increase. Along with biomedical research on the causes and possible cures for these conditions, the development and increased use of technologies that compensate for functional impairment are among the most hopeful approaches to improving the quality of life of elderly people.

OTA was assisted in the preparation of this background paper by many outside advisors and reviewers, including biomedical and social science researchers, physicians, audiologists, and representatives of the hearing aid dealers and hearing aid manufacturers associations. We express sincere appreciation to each of these individuals and organizations. As with all OTA reports, the content of this background paper is the responsibility of the Office and does not necessarily represent the views of outside advisors or reviewers.

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NOTE: OTA appreciates and is grateful for the valuable assistance and thoughtful critiques provided by the advisory panel members. The views expressed in this OTA report, however, are the sole responsibility of the Office of Technology Assessment.

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Chapter 1

Overview

Chapter 1

Overview

THE SCOPE AND IMPACTS OF HEARING IMPAIRMENT IN ELDERLY PEOPLE

Hearing impairment is a serious problem among elderly people in the United States. It is the third most prevalent chronic condition among the noninstitutionalized elderly population, exceeded only by arthritis and hypertensive disease (118, 120, 122).

Elderly people are much more likely to have a hearing impairment than younger people. Slightly more than 1 percent of all people under 17 years of age suffer some hearing impairment. But prevalence rises to about 12 percent of all people between 45 and 64, about 24 percent of those 65 to 74, and about 39 percent of those 75 and over (121).[1] The prevalence of hearing impairment among elderly people in nursing homes is even greater (98).

While only 11 percent of the Nation's population is over 65, about half of all hearing impaired people are over 65 (41). As this older segment of the population grows, the number of hearing impaired individuals will rise dramatically. The over-75 population, which has the highest prevalence of hearing impairment, is growing at a faster rate than the elderly population as a whole, thus increasing the number and proportion of hearing impaired people in the population. At present, about 7 million elderly persons have significant hearing loss. If current rates persist, by the year 2000 more than 11 million elderly persons will be significantly affected.

Hearing impaired individuals include those who are *deaf* and those who are *hard-of-hearing*. Hard-of-hearing refers to a partial hearing loss that results in difficulty with speech comprehension, although some auditory function remains. Deaf refers to a degree of impairment that renders hearing nonfunctional for ordinary purposes of life (117). Most people with hearing impairments are not deaf, but even the partial hearing loss that is common among elderly people can limit their independence and reduce the quality of their lives.

Although hearing impairment is not life-threatening and does not directly restrict physical activity, it can cause severe disability. Hearing loss limits a person's ability to interact socially with family and friends and to receive and interpret information (10). Many warning devices such as fire alarms rely on sound signals. Furthermore, hearing is an important method of identifying dangers in the environment, such as approaching vehicles. Thus, hearing impairment can affect personal safety. It can also interfere with important activities of daily living, including shopping; using public transportation; and communicating with health care professionals, tradespeople, and community service providers. When hearing impairment limits a person's ability to function independently, it can result in a need for formal and informal long-term care services.

The importance of hearing and the problems posed by hearing loss in elderly people have long been recognized. In 1968, the Senate Special Committee on Aging noted the high prevalence of hearing loss among elderly people and directed its attention to three problem areas: 1) delivery of services to older people with hearing loss; 2) hearing aid sales; and 3) the effects of increasing noise on future generations of Americans (127). During the past 18 years we have made some progress combatting these problems, but much remains to be done.

This background paper examines the kinds of hearing impairments that are most common among elderly people and the technologies that are available to compensate for them. Chapter 2 reviews the types, causes, and prevalence of hearing impairment and its impact on elderly people. Chapter 3 discusses treatment methods, including prevention, medical and surgical treatments, and devices and procedures to compensate for hearing loss. These include hearing aids, assistive listening devices,[2] telecommunication devices, and aural rehabilitation techniques. The chapter also discusses obstacles to the use of these technologies and looks briefly at problems of device development. Chapter 4 describes the existing systems that provide treatment for hearing impaired people, including the service providers, settings, and patterns of service delivery. The chapter emphasizes the need for improved delivery systems that are adapted to the needs of elderly people. Chapter 5 discusses funding for hearing devices and services.

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[1] These figures are based on the results of interview surveys. Estimates of prevalence based on audiometric testing are considerably higher. Ch. 2 discusses the differences between the prevalence estimates determined by these two methods of measuring hearing ability.

SUMMARY OF MAJOR FINDINGS AND ISSUES

The Federal Government is concerned about hearing impairment among elderly people because of its impact on their safety, quality of life, and ability to live independently. Federal initiatives that have addressed the problems of hearing impairment include funding for research, legislation to guarantee access to public facilities for hearing impaired people, and regulation of hearing aid sales. These efforts have benefited hearing impaired individuals of all ages. In addition, some funding is available to treat hearing disorders through Medicare, Medicaid, the Veterans Administration (VA), and other Federal programs.

Despite these Federal programs, many elderly people with hearing impairments are not receiving appropriate treatment or using potentially beneficial devices. Some do not seek treatment because they are not aware of their hearing loss or because they believe that nothing can be done to treat or compensate for it. Negative social attitudes about growing old and becoming hard-of-hearing cause some elderly people to deny their hearing impairments. Others are aware of their hearing loss but avoid the use of hearing aids and assistive listening devices because they do not want to call attention to their loss.

Public education is needed to increase awareness about the extent and types of hearing impairment among the elderly. Elderly people, their families, and health care professionals also need information about treatments, devices, and services that can compensate for hearing impairment. Federal, State, and local governments, private industry, and organizations representing elderly and hearing impaired people must share responsibility for public education programs that promote awareness of the problem and encourage the use of appropriate treatments, devices, and services.

Self-help groups are an increasingly strong and effective force in promoting awareness of hearing impairment and the needs of hearing impaired people. While self-help groups for deaf people have existed for some time, groups for people with partial hearing loss have developed more recently. Some of these groups are organized on a national level, sometimes with local chapters, while others function only on a local level. One example of a national group is Self Help for Hard of Hearing People, an organization with more than 15,000 members and 170 local chapters and affiliates in 41 States.

While self-help groups differ in their primary focus and mode of operation, they tend to emphasize several important points:

- the severe impact of hearing loss on many individuals;
- the need for hearing impaired individuals to admit their hearing impairments, to overcome the sense of shame that many hearing impaired people feel, and to be more assertive about their communication needs; and
- the need for families, friends, and others who interact with hearing impaired people to be aware of and use devices and communication techniques that promote effective communication.

Self-help groups also stress the heterogeneity of hearing impaired people, both in terms of the

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[2] Assistive listening devices are devices that transmit amplified sound more directly from its source to the listener; examples are audio loops, infrared, and radio frequency (AM and FM) devices (74)

Photo credit: Pete Souza, The White House

President Reagan has acknowledged his hearing loss and is using a small, canal-style hearing aid to compensate for it. By his example, the President has encouraged other hearing impaired people to acknowledge their impairments and consider the use of a hearing aid or other hearing assistive device for themselves.

type and severity of each individual's hearing loss and other physical, emotional, and social characteristics of the person and his environment that affect his communication needs. This heterogeneity creates a need for a variety of hearing devices and services and a process for determining the needs of each individual. Self-help groups point out that the hearing impaired individual is usually the best source of information about his hearing loss and that too little attention has been paid to what hearing impaired people, especially those with partial hearing loss, say about their needs.

In addition to increased awareness of hearing loss in elderly people, there is a need for increased research. Although the prevalence of hearing impairment far exceeds most diseases and disabilities of later life, the magnitude of this problem has not been reflected in the amount of research that has been conducted on underlying pathologies, prevention, treatment, and rehabilitation. As a result, the state of the art in this field has progressed more slowly than in many other fields (10).

Most hearing research has been focused on very severe impairments, and particularly the problems of deaf children. While the results of this research are sometimes applicable to elderly people, the characteristics of hearing impairments that are common in elderly people often differ from those of severely hearing impaired younger people. Hearing impairment in the elderly is often mild or moderate, but it is widespread. It is often progressive, with a gradual onset, and may not be recognized for some time. In addition, a significant but as yet undefined number of elderly people have decreased ability to tune out background noise and thus have more difficulty hearing in noisy settings than younger people with comparable hearing ability (31, 44). Finally, hearing impairment in elderly people often coexists with other health problems that can complicate treatment and limit the effectiveness of hearing devices. Research focused on the mechanisms of hearing impairment in elderly people and appropriate treatment approaches is needed.

Few of the hearing impairments common among elderly people respond to medical or surgical treatment. However, a variety of approaches, such as the use of hearing aids, other assistive listening devices, and aural rehabilitation techniques, can be used to compensate for hearing impairment. These approaches can improve communication ability even when the underlying problem cannot be cured.

Hearing aids are the most widely used devices, but most people with hearing impairments do not use hearing aids. Estimates from various studies indicate that between 8 and 25 percent of hearing impaired people use a hearing aid[3] (41, 49, 94, 119). Some of those who do not use hearing aids have been told that a hearing aid will not help them; others deny that they need a hearing aid or resist using a hearing aid for cosmetic reasons. Still others buy hearing aids but never learn to use them and eventually stop trying.

Hearing aids function well for many elderly people but do not compensate for hearing loss in others for several reasons:

- Some people buy hearing aids that are not well matched to their needs. Sometimes this occurs because they purchase an aid without having a complete hearing evaluation to identify their specific hearing deficits. Lack of Medicare reimbursement for a hearing evaluation to select a hearing aid exacerbates this problem.
- Even when a person's specific hearing deficits have been identified, lack of information comparing different types of hearing aids can make it difficult to identify the most appropriate aid.
- Hearing aids generally amplify all environmental sound, including background noise. Although design modifications can improve the speech-to-noise ratio, some hearing aid users continue to have problems tuning out background noise.
- Current hearing aid technology does not allow custom design of a hearing aid in the way that eyeglasses can be prescribed and ground specifically for an individual. Within five years, microprocessor technologies may make "prescription hearing aids" available.

In addition to hearing aids, assistive listening devices such as infrared and FM devices can benefit many hearing impaired people. These devices can be particularly effective for those with mild or moderate hearing loss and in situations where background noise is a problem. Some profoundly impaired persons can also benefit from them. Yet most elderly individuals do not know about assistive listening devices and the existing service delivery system does not promote their use. Relatively few hearing specialists offer a full range of the assistive devices. The VA Medical Center in Birmingham, Alabama, has developed a program to distribute these devices, and hearing specialists at the center receive inquiries about the devices from hearing impaired people all over the country. They refer many people to hearing specialists in their local areas, but in some areas there are no specialists trained in the use of these devices (129).

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[3] Estimates of the percentage of hearing impaired people who use hearing aids vary depending on the source of the data and the figure that is used for overall prevalence of hearing impairment.

Medicare, Medicaid, and private insurance do not reimburse for assistive listening devices or for professional advice to determine which devices are appropriate. (See ch. 5 for a discussion of funding for hearing devices and services.) Legislation to provide Medicare and Medicaid reimbursement for these devices was introduced in Congress in 1984 and again in 1985. Many observers doubt that this legislation will pass because of current budget limitations, but supporters argue that reimbursement for these devices would encourage their use, thus increasing the independence of hearing impaired people and ultimately reducing Federal spending for other services.

Aural rehabilitation services, including counseling, training in speechreading,[4] and hearing aid orientation can help hearing impaired elderly people by reducing anxiety, facilitating better use of residual hearing, and achieving more realistic expectations regarding remediation of hearing loss. Yet few hearing impaired elderly people receive aural rehabilitation services. Public education and education of health care and social service providers is needed to encourage the use of these essential services.

Hearing impaired people who cannot hear over the telephone face serious problems. They are not able to talk with family and friends, arrange necessary services, and obtain assistance in an emergency. Some people with mild or moderate hearing loss can manage well with a telephone that has an amplifier in the handset. Others have hearing aids designed with a "telephone switch"[5] and they can use compatible telephones. But not all telephones are compatible with hearing aids, and most telephones do not have amplifiers. In addition, many hearing aids are manufactured without a telephone switch. Some hearing impaired people and hearing professionals advocate Federal legislation to require that all new telephones be compatible with hearing aids. Some also advocate strengthening the Federal and State regulations that require telephone companies to make specialized equipment available to hearing impaired people for use at home.

Adapting public facilities so they are accessible to the hearing impaired is an area where progress has been very slow. Section 504 of the Rehabilitation Act of 1973 prohibits discrimination against disabled individuals by any program or activity receiving Federal assistance. The law requires that all facilities receiving any form of Federal support must provide access for people with all kinds of handicaps, including hearing impairment (80). So far, however, efforts have emphasized adapting facilities for people with problems in mobility. This has occurred even though the costs of installing an audio loop, infrared, or radio frequency (AM or FM) amplification system is usually minimal compared to the costs of the major architectural changes needed to accommodate people with mobility impairments. Although it seems incongruous, public funding has been available for architectural modifications while the cost of amplification systems has been paid primarily by the private sector (10).

The needs of older people with hearing impairments should be considered in any plans to adapt facilities for the handicapped. In addition, environmental design technologies to compensate for hearing impairment could be applied in public facilities. These technologies are discussed in chapter 3.

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[4] Speechreading is another term for lipreading. The term speechreading emphasizes that the hearing impaired person watches facial, throat, and body movements of the speaker in addition to his lip movements in order to understand what he is saying.

[5] A telephone switch, or "T switch," is a feature built into some hearing aids that allows the aid to pick up electronic signals directly from compatible telephone receivers, thus bypassing the hearing aid microphone and eliminating unwanted sound.

A final concern is the apparent tension and rivalry among the three groups of hearing specialists: physicians who specialize in hearing disorders, audiologists, and hearing aid dealers. Physicians who specialize in hearing disorders are medical doctors with training in diseases of the ear. Audiologists are nonmedical hearing specialists who have a master's or doctoral degree in audiology, the science of hearing. Hearing aid dealers are individuals who sell hearing aids who are neither physicians nor audiologists. This report refers to individuals in each of these groups as "hearing specialists." The training and unique skills of each of these groups are discussed in chapter 4.

Each group plays an important role in providing hearing services for elderly people. The continuing rivalry among them interferes with the development of service delivery systems that make the full range of devices and services available to hearing impaired elderly people. Any Federal legislation or regulations related to hearing services should discourage this rivalry and encourage the development of coordinated service delivery systems that use the expertise of each type of hearing specialist.

Chapter 2

The Epidemiology of Hearing Impairment in Elderly People

Chapter 2

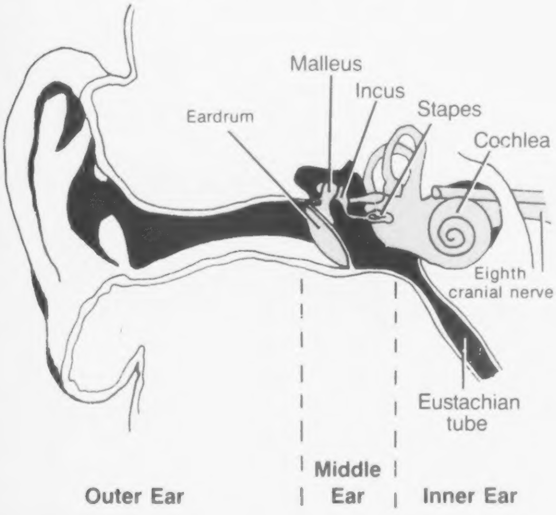
The Epidemiology of Hearing Impairment in Elderly People

TYPES AND CAUSES OF HEARING LOSS AMONG ELDERLY PEOPLE

Hearing impairment can be partial or complete. It can be unilateral (one ear) or bilateral (both ears), temporary or permanent, stable or progressive. Types of hearing impairment include conductive, sensorineural, mixed, and central processing disorders. These types are based on the site of structural damage or blockage (see figure 1). *Conductive hearing impairment* involves the outer and/or middle ear. *Sensorineural impairment* involves damage to the inner ear, the cochlea, and/or the fibers of the eighth cranial nerve. A *mixed hearing impairment* includes both conductive and sensorineural components. Causes of conductive and sensorineural hearing impairment are listed in table 1.

A *central processing disorder* is a hearing impairment that influences complex aspects of hearing, such as understanding speech. The hearing

Figure 1.—Structure of the Ear



In the healthy ear, sound waves gathered by the outer ear are transmitted through the eardrum and three small bones in the middle ear—the malleus, incus, and stapes—and into the inner ear. There sound is converted from vibrations into electrical impulses by tiny sensory receptors, called hair cells, in the cochlea. The electrical impulses pass through the eighth cranial nerve into the auditory centers of the brain.

SOURCE: Vicki Friedman, Washington University Medical Center at St. Louis.

Table 1.—Causes of Conductive and Sensorineural Hearing Impairments

Causes of conductive hearing impairments:

External blockage: buildup of wax or presence of a foreign object in the ear.

Perforated eardrum: a hole or tear in the eardrum that can occur as a result of injury, sudden pressure change, or infection.

Genetic and congenital abnormalities: malfunction and/or malformation of the outer and/or middle ear that can occur in connection with hereditary disease or as a result of illness or injury before or at the time of birth.

Otitis media: middle ear infection with fluid accumulation.

Otosclerosis: hereditary disease process resulting in overgrowth of a small bone in the middle ear which interferes with sound conduction.

Causes of sensorineural hearing impairment:

Prenatal and birth-related causes: infections such as rubella contracted by expectant mothers, drugs taken during pregnancy, or difficult labor and delivery.

Hereditary causes: a variety of disorders that damage the cochlea or higher nerve centers and are usually present at birth; the gradual loss of hair cells in the cochlea that begins as young as the twenties and thirties in some individuals and may be caused by heredity.

Viral and bacterial infections: infections such as mumps, spinal meningitis, and encephalitis.

Trauma: a severe blow to the head, an accident, or a stroke or brain hemorrhage that affect the ear, nerve pathways, and auditory brain centers.

Tumors: tumors called acoustic neuromas that invade the eighth nerve.

Noise: exposure to loud sounds that irreparably damage the hair cells.

Cardiovascular conditions: hypertension, heart disease, or other vascular problems that alter blood flow to the inner ear.

Ototoxic drugs: aspirin, some antibiotics, diuretics, and certain powerful anticancer drugs that damage the hair cells or other vital parts of the inner ear.

Meniere's disease: a disorder characterized by fluctuating hearing loss, dizziness, and tinnitus; possible causes include allergy, hypothyroidism, diabetes, and syphilis.

SOURCE: NINCDS, 1982 (124).

impaired person may hear the words but not make any sense out of them. Some words are difficult to interpret, almost as if the person were listening to a foreign language. This kind of hearing impairment can be caused by disorders of the auditory pathways in the brain. With aging, the speed of nerve impulses may slow or the brain may lose the ability to interpret words that come at a rapid pace.

Tinnitus is a condition that often accompanies hearing loss. It is a ringing, buzzing, or hissing in the ears or head that can be continuous or intermittent. The causes of tinnitus are not well understood but can include obstructions in the outer ear, perforation of the eardrum, middle ear infection, repeated exposure to loud noise, trauma, and some medications.

Presbycusis is the term most often used to describe hearing impairment in elderly people. The word presbycusis means "old hearing." It is usually defined as a sensorineural loss caused by changes in the inner ear, but some experts include middle ear changes associated with aging in the definition (124) and others emphasize the impact of changes in the eighth cranial nerve and auditory brain center (54).

The diagnosis of presbycusis is used for hearing impairment associated with a variety of sensory, neural, metabolic, mechanical, and vascular changes seen in elderly people. Yet little is known about the underlying causes of presbycusis and the term is sometimes used when no specific cause of the condition can be identified. Conditions that are frequently diagnosed as presbycusis include gradual loss of hair cells in the cochlea and fibrous changes in the small blood vessels that supply the cochlea.[1] Some researchers believe that these changes are caused primarily by environmental factors and disease while others believe they are primarily a result of normal aging (125). However, not all elderly individuals are affected by presbycusis, and some people over 90 retain acute hearing.

The diagnosis of presbycusis is sometimes given mistakenly when a specific cause of the hearing impairment could be identified and possibly treated (73). For example, wax buildup in the outer ear frequently causes hearing impairment in elderly people. If presbycusis is diagnosed, the real problem—ear wax—might be missed and go untreated.

The term presbycusis can be confusing because it is used to describe three situations: 1) treatable conditions caused by disease, 2) conditions caused by disease for which no treatment is known, and 3) conditions believed to result from normal aging. For health care professionals, elderly people, and their families, a diagnosis of presbycusis may mistakenly imply that nothing can be done for the patient. Greater attention to isolating the cause of a person's hearing loss can help ensure prompt and effective treatment in some cases. In general, however, more research is needed to describe the underlying pathologies that cause presbycusis and to differentiate between treatable and untreatable causes of these conditions.

To develop a more complete understanding of hearing loss associated with aging, we must improve our knowledge about the basic mechanisms of hearing in the normal ear. While the normal functioning of the outer and middle ear is relatively well understood, the structural and biochemical mechanisms of the inner ear and auditory brain centers are less well understood. The cochlea, a pea-sized organ with more than a million moving parts, is one of the most complex mechanical structures in the human body. Only within the past decade have methods been developed to study this tiny structure. Research on the molecular structure and mechanical properties of hair cells in the cochlea and the biochemical processes by which sound vibrations are converted to neural impulses has significantly increased our understanding of the basic mechanisms of hearing (53). But little is known about how the damaged ear processes sound (88).

Lack of communication among researchers in this field has been a problem but recent research developments have stimulated increased interaction. A national conference on auditory biochemistry held in 1984 brought many prominent researchers together for the first time and participants hope that this process will be repeated regularly (30).

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[1] The cochlea is dependent on a single artery for blood supply, making hearing very susceptible to damage as a result of cardiovascular disease (73).

MEASURING HEARING IMPAIRMENT

Hearing impairment is measured by two methods: interviews and audiometric tests. Definitions of the levels of impairment reflect these two methods. The interview method relies on self-reported hearing loss and the resulting statistics are presented in categories such as: "no trouble hearing," "can hear words spoken in a normal voice," "can hear words shouted across a room," and "at best can hear words shouted in ear" (119). Audiometric tests measure an individual's response to sounds of varying intensity or loudness, and level of impairment is reported in terms of the weakest sound the individual can hear. Intensity of sound is measured in decibels;[2] one scale used to define level of impairment is illustrated in table 2.

The level of hearing impairment that is considered significant varies for different surveys, research projects, and clinical applications. Hearing specialists and researchers continue to debate the most appropriate level to call significant for specific applications.[3]

Different surveys show different prevalence figures in part because they select different levels of impairment as significant. Reported prevalence also varies depending on whether the interview or audiometric testing method is used. Prevalence figures based on interviews tend to *underestimate* the frequency of hearing impairment because many people, particularly elderly people, are not aware of their hearing loss or may deny or minimize its severity in an interview. Some experts believe that audiometric testing provides more accurate measurement but prevalence figures based on both methods are widely cited in the literature (10).

Table 2.—Hearing Loss in Decibels Related to Approximate Degree of Impairment

Hearing loss in decibels (dB)	Degree of impairment
0 to 20 dB	Normal
20 to 40 dB	Mild
40 to 55 dB	Moderate
55 to 70 dB	Moderately severe
70 to 90 dB	Severe
>90 dB	Profound deafness

SOURCE: Knauf, 1978 (64).

Four types of audiometric tests are commonly used to measure hearing loss: 1) pure tone air conduction, 2) bone conduction, 3) speech reception, and 4) speech discrimination. Pure tone air and bone conduction tests measure hearing loss at specific frequency levels. Hearing loss varies greatly according to frequency, especially in elderly people, and information about hearing deficits at specific frequencies is important for diagnosis, treatment, and research. The prevalence of hearing loss based on audiometric tests varies according to: 1) the sound frequency used; 2) the decibel level at which hearing impairment is recognized for that particular survey, called the *fence*; 3) whether one or both ears are tested; and 4) whether data are reported for the right or left ear, the better ear, the worse ear, or an average.

Some individuals are able to hear the pure tones used in air and bone conduction tests but have difficulty understanding speech because of problems in auditory discrimination. This condition, called *dysacusis*, is widespread among hearing impaired elderly people. Pure tone air and bone conduction tests underestimate the extent of dysacusis (69) and, as a result, prevalence estimates based on pure tone air and bone conduction tests are usually lower than those based on speech reception and speech discrimination tests (41).

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[2] The decibel scale is a logarithmic scale (based on powers of 10) that measures intensity of sound or loudness. A small increase in decibels (dB) represents a large increase in loudness. For example, a sound at 40 dB is 10 times as loud as a sound at 30 dB and 100 times as loud as a sound at 20 dB.

[3] This debate is relevant to screening programs and identification of patients who need treatment as discussed in ch. 4.

PREVALENCE

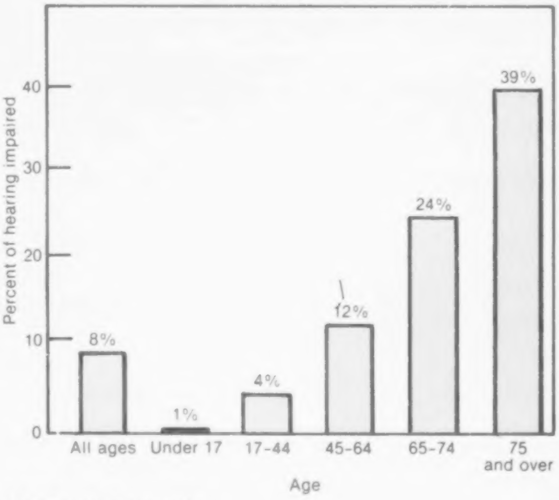
The prevalence of hearing impairment varies by age, sex, race, income, and institutional status. Prevalence estimates also vary depending on whether they are based on interview or audiometric testing.[4] There is ongoing debate about the accuracy of interview and audiometric tests for measuring hearing impairment and about the level of hearing loss that constitutes significant disability. These debates are relevant to understanding whether prevalence estimates are valid.

The data in the following discussions reflect our best understanding of the nationwide prevalence of hearing impairment. However, the generalizations may not apply in certain geographic areas. For example, chronic ear infections are common among certain ethnic groups in Alaska and Indians in some Southwestern States and this increases the prevalence of hearing impairment in those areas. Similarly, in areas where high-noise industries are concentrated, hearing loss is more common among persons of working age and older (10).

Age

According to the 1977 National Health Interview Survey (NHIS), about 8 percent of the civilian, noninstitutionalized population experienced some degree of chronic hearing impairment. Prevalence rises from about 1 percent of those under age 17 to more than 38 percent of those over 75 (see figure 2).

Figure 2.—Prevalence of Hearing Impairment, Including Tinnitus, in the Civilian, Noninstitutionalized Population, United States, 1977



SOURCE: NCHS, 1981 (120)

Audiometric surveys also show significant increases in hearing impairment with age and they indicate a higher overall prevalence than interview surveys (41, 51). For example, one national audiometric survey showed that almost 30 percent of individuals between 65 and 74 and 48 percent of those between 75 and 79 had impaired hearing for understanding speech (69).

Audiometric data show that hearing loss is greater for high frequency than for low frequency sounds for all age groups. As figure 3 indicates, hearing impairment at high frequencies is very common among elderly people.

While most speech is in the range of 500 to 2,000 Hz,[5] sounds such as *s, th, k,* and *f* are heard at higher frequencies. Elderly individuals with hearing impairments at 4,000 Hz (i.e., almost 60 percent of all elderly people) are often unable to hear these sounds and this interferes with their understanding of normal speech.

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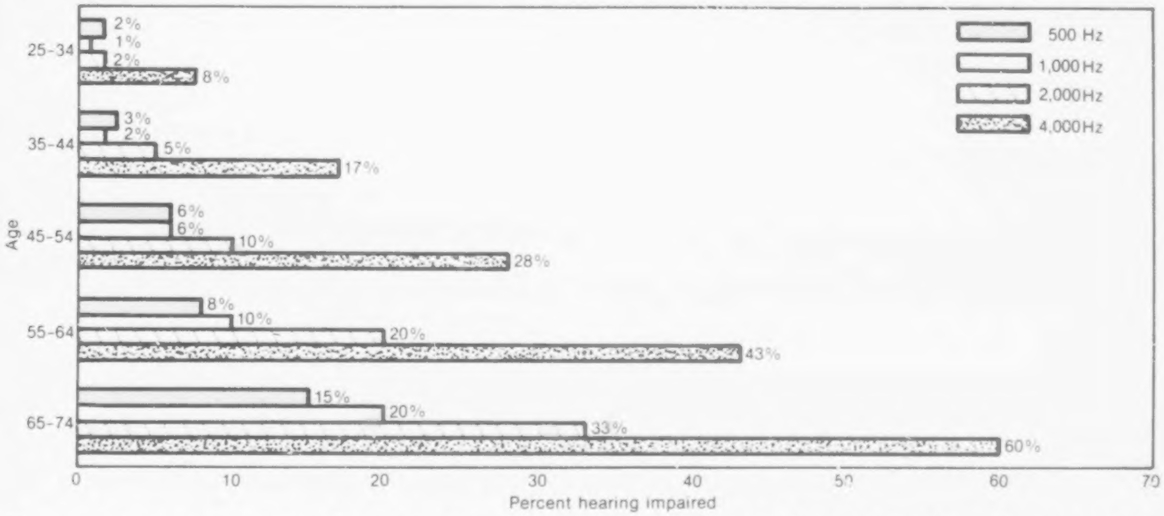
[4] Prevalence figures based on interviews come from the 1977 National Health Interview Survey (NHIS), conducted by the National Center for Health Statistics (NCHS). NHIS is an annual nationwide survey. Respondents are asked about acute and chronic health conditions of all members of the household. In 1977, a special supplement to the NHIS focused on hearing impairment. NHIS data are believed to underestimate prevalence because some people deny or are unaware of their hearing impairments or may not consider their hearing loss a problem and because NHIS interviews are usually conducted with only one member of the household, who may not be aware of or report hearing impairments of other household members.

Prevalence figures based on audiometric testing come from the Health and Nutrition Examination Surveys (HANES), conducted from 1971 to 1975 by NCHS. A random sample of adults aged 25 to 74 in the civilian, noninstitutionalized population was tested using pure tone air and bone conduction tests at 4 frequency levels (500, 1,000, 2,000, and 4,000 Hertz) and a speech reception test. Air and bone conduction tests were reported for the right ear only; this lowers prevalence estimates because those with unilateral hearing loss in the left ear are not included.

Both NHIS and HANES underestimate overall prevalence in the elderly population because the institutionalized elderly, who have very high prevalence, are not included.

[5] Frequency is measured in vibrations or cycles per second, called Hertz (Hz).

Figure 3.—Prevalence of Hearing Impairment Among Adults by Frequency of Tone, United States, 1971-75ᵃ



ᵃThese data are based on air condition tests. Figures include individuals who were able to hear the tones at 31 decibels or more at least 50 percent of the time.
SOURCE: NCHS, 1980 (116).

Gender

Interview surveys indicate that elderly men have a higher prevalence of hearing impairment than elderly women. The 1977 NHIS found that among people 65 to 74, about 29 percent of men reported hearing impairments compared to only 20 percent of women. Among those 75 and over, 44 percent of men but only 35 percent of women reported hearing impairments (121). Some experts suggest that these different rates are the result of lifelong exposure to loud noise while hunting, serving in the military, or working in farm and factory occupations (10, 129).

Longitudinal studies indicate that men and women aged 50 to 80 experience hearing loss in the same frequency range, but hearing loss increases more rapidly in men than in women. After age 80, these differences in hearing impairment between men and women become indistinguishable (54, 123).

Audiometric data show much higher prevalence of *high* frequency hearing impairment for elderly men than for elderly women, but elderly women have similar or slightly higher prevalence at *low* frequencies (54). For example, air conduction tests used in the Health and Nutrition Examination Survey (HANES) showed that 78 percent of the men from age 65 to 74 had hearing loss at 4,000 Hz, compared to only 46 percent of the women in that age group. In contrast, at 500 Hz about 12 percent of elderly men and 18 percent of elderly women had hearing loss, while at 1,000 Hz about 18 percent of elderly men and 21 percent of elderly women had hearing loss.[6] Bone conduction tests produced similar findings (116). The reason for this variation in prevalence for men and women at different frequencies is not known.

Race

The 1977 NHIS indicated a substantially lower prevalence of hearing impairment among nonwhites of all ages than among their white counterparts (see table 3).

Audiometric data show a more complex relationship between race and hearing impairment. HANES data indicate that elderly nonwhites have

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[6] Figures include individuals who were able to hear the tones at 31 dB or more at least 50 percent of the time.

Table 3.—Prevalence of Hearing Impairment, Including Tinnitus, in the Civilian, Noninstitutionalized Population, by Race and Selected Age Groups, United States, 1977

Age	Race White	 All other
Under 17 years	1%	1%
17 to 44	4	3
45 to 64	13	8
65 to 74	25	18
75 and over	39	31

SOURCE: NCHS, 1981 (120).

a lower prevalence of *severe* hearing impairments than elderly whites, but a higher prevalence of *moderate* hearing impairments.[7] This distinction is true for pure tone air conduction measures at 500, 1,000, 2,000, and 4,000 Hz. On speech reception tests elderly nonwhites had a higher prevalence of hearing impairment at all levels of severity except profound deafness (116). The difference between these results and data from interview surveys suggest that elderly nonwhites may be less likely than elderly whites to report hearing impairment in an interview.

Income

In general, persons with low family income have a higher rate of hearing impairment at all ages than their wealthier counterparts. For example, the 1977 NHIS found that the rate of impairment for persons aged 65 to 74 with annual family incomes below $3,000 was about 30 percent. For the same age group with incomes in excess of $15,000, the rate was about 20 percent (121). With only minor variation, this inverse relationship between income and hearing loss is sustained for all age categories. Although the reasons for this relationship are not known, it may be because low income people have poorer general health, poor primary health care, and greater exposure to environmental noise and this results in higher prevalence of hearing impairment (10, 42).

Institutionalization

The prevalence of hearing loss among institutionalized elderly people is greater than among noninstitutionalized elderly people. One survey in a Veterans Administration nursing home found that 90 percent of the residents had hearing impairments (132). A review of research on hearing loss among nursing home residents found prevalence estimates ranging from 48 to 82 percent (98). The variation among these findings is attributed to: different methods of measuring hearing loss, the types of nursing homes studied, characteristics of the selected population, lack of uniform interpretation of "hearing loss," and lack of information about threshold sensitivity at individual frequencies.

A study of hearing impairment in a nursing home in Canada pointed out the inadequacy of self reports for assessing hearing impairment in this type of setting (22). Residents were interviewed about their hearing ability and given audiometric tests. Fifty percent of the residents acknowledged a hearing loss in interviews, but audiometric testing showed that 75 percent actually had hearing impairments. Eight percent of the residents reported hearing loss when there was no audiometric evidence of impairment, while 33 percent reported normal hearing but actually had clinically significant loss. Audiometric testing should be a routine procedure for elderly people admitted to nursing homes since hearing loss, including unrecognized loss, can affect a person's ability to function normally.

Prevalence of Tinnitus

The prevalence of tinnitus increases with age (see figure 4) and more women than men report tinnitus (69).

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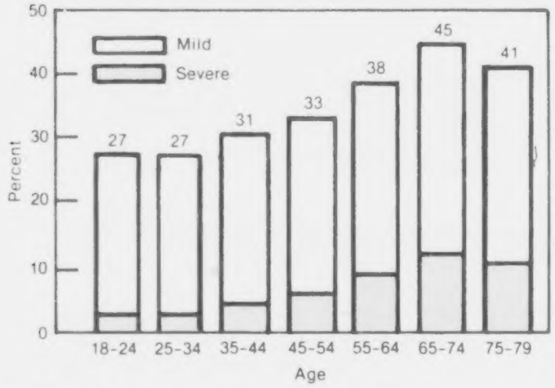
[7] For this comparison, hearing impairment above 50 dB is considered severe, while impairment from 31 dB to 50 dB is considered moderate.

Figure 4.—Prevalence of Tinnitus, by Severity and Selected Age Groups, United States, 1960-62[a]



[a] Percentage figures rounded to nearest whole number.
SOURCE: Leske, 1981 (69).

THE IMPACT OF HEARING IMPAIRMENT

Clinical Impact

Hearing impairment lessens a person's ability to hear environmental sound without amplification. In some cases it also diminishes the ability to discriminate between sounds even with amplification. This condition is common among hearing impaired elderly people and results in the complaint, "I can hear you, but I can't understand you" (54, 89). Some research indicates that auditory discrimination is a problem even for some elderly people with *normal* hearing as measured by pure tone audiometric tests. This is less often true of younger people with normal hearing measured in the same way (63).

Loss of the ability to hear high-frequency sounds is characteristic of hearing impairment in many elderly people. At birth the human being is able to hear sounds as high as 30,000 Hz, but each year of life results in some loss. By the teens, many individuals can hear only up to 20,000 Hz, and by old age many people cannot hear sounds at 4,000 Hz or even 2,000 Hz, the level of some speech sounds (32).

Elderly people with hearing impairment usually have diminished ability to hear low-intensity sounds, but their ability to hear very loud or high-intensity sounds can remain unchanged. This can make it uncomfortable to use hearing devices that amplify all sounds uniformly because relatively loud sounds that are amplified then become intolerably loud (89).

Another common characteristic of hearing impairment in elderly people is an inability to tune out background noise. Many elderly people experience difficulty hearing in a noisy environment because they cannot separate speech from background noise (54, 82). Although available data are not conclusive, studies suggest that elderly people have more difficulty hearing in a noisy environment than younger people with comparable hearing ability. Furthermore, even elderly individuals with *normal* hearing ability, measured by audiometric tests, can experience problems with background noise (31, 44). Sound reverberations in large rooms such as auditoriums and churches also interfere with speech perception among many elderly people.[8]

In the normal ear, the *efferent system* is a system of complex neural mechanisms that act to control discrimination of sound, detection of sound signals in noise, and localization of sound. Little is known about how this system inhibits response to some auditory signals and tunes out unwanted sound. Further, it is not known how the efferent system changes with age and whether such changes are part of why elderly people have difficulty understanding speech in noisy environments. Continued research on the mechanisms of selective inhibition could help increase our understanding of hearing impairment in the elderly (30).

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[8] Ch. 3 discusses the implications of these findings for hearing aid design, the use of assistive listening devices, and environmental design technologies. Implications for screening programs and identification of people who need treatment are discussed in ch. 4.

Psychosocial Impact

Hearing impairment causes psychological and social difficulties because it interferes with a person's ability to communicate effectively. Communication plays an essential role in maintaining relationships and the quality of life, and hearing loss deprives not only the individual, but also family and friends, of easy communication. Repeated instances of unheard or incorrectly heard communication are frustrating for the individual and everyone he converses with and may cause all those involved to initiate conversation less frequently. When these frustrating situations occur over prolonged periods, family relationships can be severely strained. Hearing loss also can affect a person's ability to speak clearly because his own voice sounds distorted, and this can add another impediment to communication.

Hearing loss limits a person's ability to enjoy many forms of entertainment, such as television, radio, music and theater, and as a result he may withdraw from them. Similarly, some hearing impaired people stop going to church and social gatherings because they cannot hear well enough to enjoy these activities (32, 54). Hearing impairment also limits access to information that is normally available through personal communication, television, radio, and telephone. Elderly people who have both hearing and visual impairments are even more severely limited in their access to information.

Aging can bring many kinds of losses: loss of income and decreased sense of usefulness associated with retirement; loss of relationships due to the death of spouse, siblings, and friends or due to a physical move from a familiar home or community; and diminished health, energy, and mobility. While most elderly people cope well with these losses, hearing impairment can hinder the coping process by interfering with the person's ability to become involved in new activities, form new relationships, and arrange for needed services (10).

For some people, hearing impairment can lead to withdrawal, social isolation, and depression caused by lack of interpersonal communication and contact. One British study found a significant relationship between depression and hearing impairment among community dwelling elderly people (51). Another study, however, found no correlation between hearing impairment and either depression or social interaction (112). The researchers suggest that the subjects in the latter study may not be typical of the elderly population because of their general good health, economic security, and high level of education. Further research is needed to clarify the relationship between these variables.

Clinical observation suggests that there is a relationship between hearing impairment and psychopathology in some individuals. Particularly when hearing impairment occurs gradually, as it often does in later life, deaf and hard-of-hearing individuals sometimes develop delusions of persecution and other paranoid reactions. These symptoms may occur because the older person is not aware of his hearing impairment—he notices that others seem to be talking in his presence but too quietly for him to hear or that they are laughing about something he cannot hear. He becomes suspicious and may accuse them of excluding him deliberately. When they deny these accusations, he may become more suspicious.

Research has demonstrated this relationship between hearing impairment and paranoid symptoms (139). College students were hypnotized to induce temporary hearing impairment and then asked to work with others on a joint project. These subjects tended to develop symptoms of paranoia, including suspiciousness, grandiosity, irritability, and judgmental attitudes.

Some clinicians and long-term care providers have suggested that hearing impairment can cause or exacerbate mental deterioration in old age (10).

One study found a significant relationship between hearing impairment and dementia (51). The relationship did not hold up, however, when age was controlled, indicating that while both hearing impairment and dementia are associated with advancing age, they are not otherwise correlated. Another study showed that hearing impaired individuals do as well as individuals with no hearing problems on *nonverbal* tests of cognition but less well on *verbal* tests (112). It is not known whether these results occur because the hearing impaired individuals do not hear the questions on verbal tests clearly or whether some types of hearing impairment interfere with cognitive processes for encoding and recalling verbal messages.

Changes in brain function associated with aging can affect hearing, according to a report prepared by the Working Group on Speech Understanding and Aging of the National Academy of Sciences. The report, to be published in 1986, indicates that physiological changes in the brain that affect overall brain function (not only the auditory brain centers) can result in slowed response to auditory stimuli (113). Continued research on the relationship between cognitive change and hearing loss is needed.

Perhaps more important than any actual relationship between hearing impairment and mental deterioration is a widespread assumption in society that elderly persons who are hearing impaired are also confused (30, 112, 124). A strong tendency exists to stereotype elderly people as senile (95) and the additional factor of a hearing loss increases stereotyping. In a study conducted in an acute care hospital, health care professionals described their impatience with elderly persons with hearing losses (9). Several respondents said the method they used in interactions was to "scream at them." This behavior was considered acceptable since the patients were old "and probably senile, too."

Other negative attitudes about individuals with hearing impairments are also widely held. People seem to be more sympathetic to visible impairments and may be more sympathetic to blind people than to those with hearing impairments. Moreover, there is an unfortunate tendency to blame the hearing impaired person for his or her disability, especially if the person is also old. This tendency may partially explain the sense of shame that many hearing impaired people feel (82). Finally there is a common belief among health care providers, as well as among the general public, that hearing loss in elderly people is not treatable (10).

A study comparing hearing impaired elderly people who did not seek treatment with those who did seek treatment identified two factors that affected whether people sought help: 1) the severity of the impairment, and 2) the onset of hearing impairment before retirement age. Both elderly individuals and their physicians can have negative attitudes about hearing loss that begins in old age. This can play an important role in determining which individuals seek treatment (55).

Nursing home residents are very likely to have hearing impairments that can be particularly devastating for several reasons. The move to a nursing home requires adjustment to a new environment, new people, and new daily routines. Hearing impairment interferes with the individual's ability to develop relationships with staff and other patients and to fully understand the daily schedule. One regular visitor to a nursing home reports a comment that is heard all too often with regard to hearing impaired residents, "Don't bother talking to her, she can't hear you" (14).

Some hearing impaired nursing home residents have mobility impairments that interfere with their ability to interact with others and other sensory impairments, such as vision and speech deficits, that further reduce their ability to socialize. These multiple impairments compound the isolation often associated with severe hearing loss. Finally, many nursing home residents have irreversible mental impairments caused by strokes, primary degenerative dementias such as Alzheimer's disease, or other disease conditions. In this context, it is easy for nursing home employees to assume that hearing impaired residents who do not answer questions correctly and do not seem to understand the daily routine are also mentally impaired. The impact of this assumption on the hearing impaired resident's quality of life can be very severe.

Denial of Hearing Impairment

Many elderly people deny they have a hearing problem despite substantial evidence to the contrary. Many authors have discussed the problems of denial and refusal to seek treatment (76), but little attention has been given to the underlying reasons for it. Elderly people who deny or avoid confronting a hearing loss are not doing so in a vacuum. Negative social attitudes about hearing impairment and growing old encourage denial. Hearing impairment is not visible, and invisibility facilitates denial. In addition, hearing impairment in elderly people often has a very gradual onset that can make it difficult to recognize.

For elderly persons with one or more life-threatening illness, hearing impairment may seem insignificant in comparison. The onset of depression, withdrawal, paranoia, and other mental health problems associated with hearing impairment is slow and insidious and may seem unrelated to the hearing loss. An elderly person's inability to receive aural cues can lead to accidents, though the causes may seem ambiguous. Likewise, difficulties in communication and social relationships may not be attributed to hearing loss, even when the loss is acknowledged. As a result, hearing impairment often is mistakenly seen as unimportant by elderly people, their families, and health care providers (10). This denial of the importance of hearing impairment and our failure to recognize its full impact on independent functioning are clear obstacles to effective treatment.

DEAFNESS

Only a small percentage of elderly people are deaf. There is no consensus about the exact prevalence of deafness, in part because of variation in the method used to measure hearing impairment and the level of impairment that is defined as deafness. However, estimates using audiometric tests indicate that about 2 to 4 percent of all elderly people are deaf (116, 119). Among people over 75, prevalence increases somewhat, and if people with severe hearing impairments are included, prevalence increases significantly.

For practical purposes elderly deaf people can be divided into three groups: 1) those who became deaf very early in life before language was acquired, 2) those who became deaf during early or middle life after language was acquired, and 3) those who became deaf during later life. People who have been deaf since childhood have usually learned to use sign language and have deaf and nondeaf friends and associates with whom they can communicate using sign language.[9] Since their method of communication is manual, their ability to communicate usually does not diminish with age. Some people who became deaf in early or middle life use speechreading as their preferred mode of communication. Visual impairments acquired late in life can interfere with their ability to use speechreading techniques.

Individuals who become deaf late in life face different problems. Sign language is an entirely new and complex system of communication that they must learn if they are to interact with other deaf people who use sign language. Yet their relatives and lifelong friends seldom know sign language. The result can be extreme social isolation.

People who are deaf and people with partial hearing loss are similar in some ways and very different in others. Both groups can benefit from increased awareness of their communication problems among their families, friends, health care and social service providers, and others who interact with them. Yet the devices and hearing services that are most effective for each group are different. For example, sign language and telecommunication devices that rely on visual messages, such as the telecommunication devices for the deaf (TDDs) described in chapter 3, are most effective for deaf people. In contrast, hearing aids, assistive listening devices, and telephone amplifiers are more appropriate for those with partial hearing loss.

In the past, hearing research and many hearing services have focused on deaf and very seriously hearing impaired people, and less emphasis has been placed on partial hearing loss (10). When deaf people and those with partial hearing loss are combined into a single category—"the hearing impaired"—at least 16 million people are included. Yet this large number is sometimes used to justify funding for research programs and hearing services focused primarily on the deaf—a group of about 2 million people. Self-help groups for hard-of-hearing people have pointed out this discrepancy (109), and funding agencies and hearing research centers are slowly readjusting their research and service priorities to encompass the very large proportion of hearing impaired people who are not deaf.

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[9] This network of informal relationships is often referred to as the "deaf community."

Chapter 3

Treatment of Hearing Impairment

Chapter 3

Treatment of Hearing Impairment

The options available for treating hearing impairment in elderly people are generally the same as for younger people. However, the suitability and effectiveness of various treatments differ considerably among age groups because of the type of hearing loss most frequently encountered and because of other physical, psychological, and social characteristics of each group (10).

Preventing hearing impairment is an obvious first approach. Even if hearing impairment cannot be completely avoided, preventive measures can slow the rate of deterioration or reduce the ultimate severity of the impairment. A second approach is medical and surgical treatment. While these treatments are effective for some types of hearing impairment, the types of hearing problems that are most common in elderly people are not presently treatable with medical or surgical methods. Thus alternatives are needed. These generally do not change the underlying hearing loss but instead help compensate for hearing loss and maintain adequate communication. They include the use of hearing aids, assistive listening devices, telecommunication devices, signaling and alarm devices, and environmental design technologies. In addition, aural rehabilitation services can help hearing impaired people communicate more successfully with or without the use of amplification devices.

PREVENTION

Some causes of hearing impairment in elderly people are not well enough understood to allow effective preventive measures. For example, dietary factors and circulatory changes have been implicated as accelerators of deterioration in the auditory system. Yet the specific relationship of these factors to hearing loss is not known, and further research is needed before preventive strategies can be developed (10).

Other causes of hearing impairment are well understood and often preventable; these include untreated ear infections, exposure to loud noise, and some medications. Untreated or inadequately treated ear infections at any time in life can cause conductive hearing loss, though it may not be immediately disabling. In old age, however, as sensorineural loss further reduces hearing acuity, serious disability may develop. Thus better health care throughout life could prevent some hearing impairments in old age (10).

Exposure to loud noise at any age can cause irreversible sensorineural damage and significant hearing loss. Airplanes, motorcycles, heavy traffic, farm and industrial machinery, gunfire, and loud music are sources of noise that can permanently damage hearing. Other sources of loud noise have also been identified. For example, the American Academy of Otolaryngology—Head and Neck Surgery has recently warned that some types of cordless telephones can cause hearing loss because the phones continue to ring at a high decibel level after being answered until a switch is flipped to the "talk" position. Seven million of these cordless phones were estimated to have been sold in 1984 (2).

The popularity of loud rock music, along with a rise in other environmental noise, creates a severe threat to the auditory acuity of young people. A 1968 study of hearing impairment among students in Knoxville, Tennessee, showed that 4 percent of sixth graders had hearing loss at high frequencies. This proportion increased to 11 percent of ninth graders and 33 percent of freshmen at the University of Tennessee. A year later, a similar study showed that more than 60 percent of the next freshman class had some hearing loss (70). As these individuals grow older, their noise-induced hearing loss may be exacerbated by the auditory changes associated with aging.

Self Help for Hard of Hearing People, one of the self-help groups for hearing impaired people, has developed a "Quiet School Program" to provide information and educational materials to school administrators, teachers, students, and parents about the relationship between loud noise and hearing loss. The materials include colorful posters and a device that flashes a warning light when noise in the school cafeteria reaches a dangerous level (101).

The increased use of portable radios and tape players with earphones may cause a greater prevalence of noise-induced hearing loss. A study in New York City found many listeners playing their portable radios at 100 decibels, the equivalent of a car horn 3 feet away (65). A recent British report concluded, however, that portable radios and tapeplayers are a less serious threat to hearing than are other sources of loud noise such as industrial machinery and gunfire (38).

Federal legislation to control noise includes the Occupational Safety and Health Act of 1970 and the Noise Control Act of 1972. Federal regulations define the amount of time that workers may be exposed to noise of a given intensity. Noise control procedures have been implemented in some industries. In addition, some local governments have enacted noise control legislation and violators are being prosecuted (111). These efforts eventually may reduce the prevalence and severity of noise-induced hearing loss. Many incidents of exposure to loud noise, however, are not within government regulatory control. Increased public education is needed to alert people of all ages to the impact of loud noise on hearing and the long-term damage that can result.

Some drugs also damage auditory mechanisms. Although not a major cause of hearing impairment, these "ototoxic" drugs must be considered in any discussion of prevention. The best known of these drugs are the aminoglycosides, a class of antibiotics that includes streptomycin. These drugs can be life-saving; unfortunately, they also sometimes damage hearing (10). Even commonly used, over-the-counter drugs such as aspirin can be ototoxic, although probably only in the high dosages sometimes used to treat arthritis. Fortunately, aspirin-induced hearing loss is usually reversible if it is recognized early and aspirin dosage is reduced (10).

Ototoxic drugs can create problems in people of any age. Nevertheless, diseases that require their use are more prevalent in later life. Too little research has been done to provide a full understanding of the mechanisms of ototoxicity and of the essential chemistry of the agents that may be ototoxic. Educational efforts have been effective in informing most physicians of the potential hazards of streptomycin, but the ototoxic effects of other drugs have been less well publicized (10).

Hearing loss is a symptom with many possible causes and accurate diagnosis can sometimes help prevent permanent hearing impairment. Yet some elderly people do not receive thorough diagnostic evaluation. Symptoms such as sudden onset of hearing impairment and unilateral deafness suggest a diagnosis other than presbycusis, and medical evaluation of patients with these symptoms can sometimes lead to effective treatment (73).

MEDICAL AND SURGICAL TREATMENT

Medical and surgical treatment can resolve conductive hearing losses that originate in the outer or middle ear, but the sensorineural losses that are most common among the elderly generally cannot be treated with available medical and surgical methods. Cochlear implants can alleviate profound sensorineural hearing loss in some individuals and research continues to improve these devices.

Treatment of Conductive Hearing Impairments

Wax buildup in the outer ear is common among the elderly and interferes with the passage of sound to the middle ear. Recognizing this problem and removing the impacted ear wax can improve hearing even if there are other auditory deficits.[1]

Middle ear disease is most common in childhood but it also occurs in adulthood and old age. Otitis media (infection of the middle ear) can be caused by allergies or upper respiratory infection and effective treatment may require medication. Perforation of the eardrum can occur at any age as the result of middle ear infection or direct trauma. Repair occurs without treatment in some cases, while surgical repair is needed in other cases

Otosclerosis impairs movement of the stapes, a small bone in the middle ear. The impaired movement causes progressive hearing loss. While the most common age of onset is in the third or fourth decade of life, surgery can be beneficial at any age and carries only a small risk of complication (27).

Treatment of Sensorineural Hearing Impairments

Although most sensorineural losses cannot be corrected through medical or surgical intervention, some losses due to tumors, sudden vascular changes, or fluid pressure changes affecting the inner ear or auditory nerve can be treated. These disorders, however, are relatively infrequent in elderly people (12).

Acoustic Tumors

Acoustic tumors can cause sensorineural hearing loss, vertigo (dizziness), tinnitus, facial paralysis, or numbness. These tumors generally occur during the third or fourth decade of life but may also occur in the sixth and seventh decade (135). These tumors can be fatal and surgical removal is a life-saving measure, but it does not usually result in improved hearing.

Meniere's Disease

Sensorineural hearing loss can also result from Meniere's disease, the symptoms of which include fluctuating hearing loss, tinnitus, pressure in the ears, and vertigo (93). The cause of Meniere's disease is not known. Treatment with medication is the first choice, and surgery is used only when hearing loss or disabling vertigo persists despite drug therapy. Rates of success with surgery vary from 62 to 95 percent, depending on the type of surgery performed (92).

Cochlear Implants

The cochlear implant is an electronic device designed to give persons with profound bilateral sensorineural hearing loss an improved sense of sound. Part of the device is surgically implanted in the inner ear and part of it is worn externally (see figure 5). The cochlear implant is intended to neuroelectrically simulate natural hearing, but full attainment appears far in the future (10). The sound produced by these devices has been described as fluctuating, grating noises and buzzes (88), and users need extensive training to learn to interpret the sound. Yet implants have improved speechreading ability—at least in isolated experiments—by giving rudimentary clues to a speaker's words (25). These devices also provide a sense of the duration, rhythm, and loudness of sound that can be helpful in understanding speech and identifying environmental sounds (8, 71).

Cochlear implants hold most promise for deaf people whose transducing organ in the cochlea is ineffective but whose auditory nerve endings are still responsive to direct stimulation (88). In the past 20 years, hundreds of people worldwide

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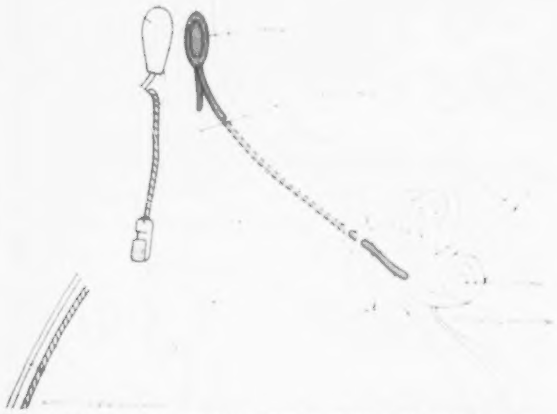
[1] Removal of impacted ear wax can be difficult and painful and should be done under the supervision of a physician.

Figure 5.—Cochlear Implant in Place



The cochlear implant translates sound into electrical signals, bypassing damaged tissues in the inner ear and allowing the brain to receive auditory information. It works as follows: An external microphone detects sound which is translated into electrical impulses by a signal processor and then transmitted to an external coil positioned behind the ear. This coil induces a like signal in another coil implanted inside the skull. From the internal coil, the signal is carried to an electrode in or on the cochlea, stimulating nearby auditory nerve fibers to transmit messages to the brain. This diagram shows the parts of the implant designed by William House and his colleagues. Other systems are similar, except that the external coil and microphone may be worn on a headset and multichannel devices have more electrodes.

SOURCE: D. Grady, "Sounds Instead of Silence," *Discover*, 1983.

have received experimental cochlear implants, and many of them have been enthusiastic about the results (71). No statistics are available on the number of elderly persons who have received implants or their response to them. In 1984, the Food and Drug Administration (FDA) approved one type of cochlear implant for clinical use in the United States, a device developed by William House and 3M Corp. In 1985, FDA approved a more sophisticated implant developed in Australia.

Research on cochlear implants continues at the House Ear Institute of Los Angeles; the Kresge Hearing Research Institute at the University of Michigan; Stanford University Medical School; University of California, San Francisco; Johns Hopkins University School of Medicine; and other hearing research centers. One focus of research is improving the sound processing capabilities of the devices. Another focus is the development of multichannel devices that are expected to allow more realistic sound perception for the individual (71). The House implant illustrated in figure 5 is a single-channel device with a single stimulating electrode, and the Australian device mentioned above is a single-channel device with 22 stimulating electrodes. Four- and eight-channel devices are now being tested and some people report significant improvement in speech recognition with these devices. Researchers believe that with enough channels, the cochlear implant could restore normal hearing. However, the difficulties involved in designing a multichannel device and successfully placing and maintaining it in the tiny, spiral-shaped cochlea are formidable (71).

Cochlear implants can damage remaining nerve fibers and other delicate tissues in the patient's ear. As a result, researchers in England, Austria, and Switzerland are working on "extra cochlear" devices, where the electrode is implanted outside the cochlea (45).

In its present form the cochlear implant is not appropriate for most elderly people because they have partial hearing loss rather than the profound deafness for which the device is now used. Anecdotal evidence indicates that some people who have had implants have been severely disappointed by limitations on the sounds they are able to hear (128). Cochlear implants are expensive, ranging from $12,000 to $15,000 for preoperative evaluation, surgery, the device, and postoperative auditory training (8). In the future, however, as cochlear implants are improved through research and testing they may become an important treatment option for elderly people.

HEARING AIDS

Since only a small portion of elderly people with hearing impairments can benefit from medical or surgical treatment, other approaches to mitigate the problem are essential. For many years, hearing aids were the only available option. Recently there has been increased interest in other devices that can help individuals with hearing impairments and these devices are discussed later in this chapter.

Hearing aids are amplification devices that compensate for partial hearing loss. The individual must have some residual hearing to benefit from a hearing aid. The earliest hearing aids were mechanical "ear trumpets" that gradually evolved into the small, more effective, battery-powered technology that is available today.

Hearing aids are available in five basic styles: on-the-body, over-the-ear, eyeglass, and two in-the-ear styles (see figure 6). On-the-body aids have a receiver that is attached to clothing or carried in a pocket. Ear-level aids are worn over the ear or fitted into the temple bar of eyeglasses. In-the-ear aids include one style that fits into the auricle or outer area of the ear and a smaller device, the canal style aid, that fits almost completely into the ear canal.

Until recently, the most frequently sold hearing aids were over-the-ear aids, but beginning in 1983 in-the-ear styles have outsold the other types. In-the-ear aids are popular because of their small size, and the canal style aid, which first appeared on the market in 1982, is extremely popular for this reason. Table 4 shows the types of hearing aids sold in 1984. Canal style aids are included in the "in-the-ear" category. Sales of canal style aids increased from less than 1 percent of total hearing aids sold in 1982 to 9 percent in 1983, and 22 percent in 1984 (23). About 65 percent of people who bought hearing aids in 1984 were fitted for one aid, while about 35 percent were fitted for two aids, one for each ear (23).

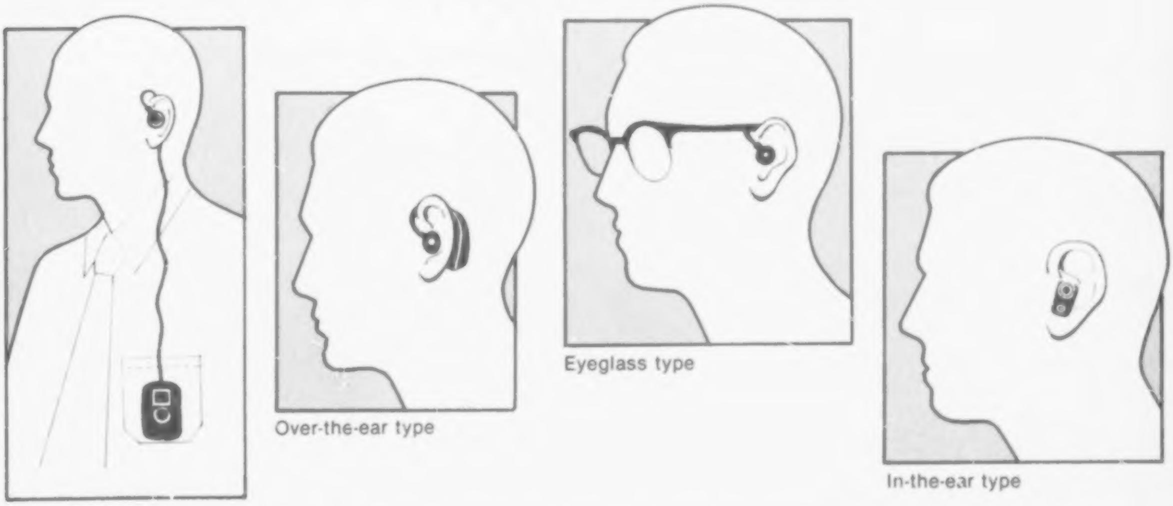
In the past, on-the-body aids could provide more amplification than other types of aids and were therefore recommended for people with severe hearing impairments. Recent technological advances in the miniaturization of hearing aid components now make it possible for individuals with severe hearing impairments to use ear-level aids. Increased miniaturization, however, has raised concern about the quality of sound provided, par-

Table 4.—Types of Hearing Aids Sold in the United States, 1984

Type of aid	Percent of total sales
In-the-ear	60.0%
Over-the-ear	37.0
On-the-body	1.5
Eyeglass	1.5

SOURCE: Cranmer, 1985 (23)

Figure 6.—Hearing Aid Types



On-the-body type

Over-the-ear type

Eyeglass type

In-the-ear type

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ticularly with devices as small as canal style aids. Miniaturization of the microphone and speaker elements of hearing aids has been less effective than miniaturization of the electronic circuitry, and this can result in sound distortion—a serious drawback for elderly people who have difficulty with auditory discrimination (54, 60). While research continues to improve the miniaturized components of hearing aids, some hearing specialists worry that people may select a small hearing aid that is not well suited to their needs because of its cosmetic appeal.

Over the years, hearing aids have helped millions of people by maximizing their residual hearing and allowing them to function in communication situations that otherwise would have been impossible. Yet most people with hearing impairments do not use hearing aids. Estimates of the percentage of hearing impaired people who use hearing aids vary depending on the source of the data and the figure that is used for overall prevalence of hearing impairment. A recent analysis using three different prevalence rates estimates that between 8 and 17 percent of all hearing impaired people use hearing aids (41). A 1984 industry survey indicated that of the 16 million people of all ages with hearing impairments in the United States, about 4 million (25 percent) own hearing aids. About 2 million others (12.5 percent of hearing impaired people) do not admit to having a hearing impairment, and the remaining 10 million (62.5 percent) admit to having a hearing impairment but do not have a hearing aid. Of those who own hearing aids, about 14 percent do not use them (49).

The majority of hearing aid users are elderly. Table 5 gives the age breakdown of individuals who bought hearing aids between 1983 and 1985.

Table 5.—Proportion of Hearing Aid Purchasers by Age, 1983-85

Age	Proportion of all hearing aid purchasers	
2 to 39	8%	
40 to 49	3	
50 to 59	11	
60 to 69	31	78%
70 to 79	30	
80 to 89	14	
90 to 99	3	

SOURCE: Market Facts, 1985 (75).

Elderly people with hearing impairments are more likely to use hearing aids than younger people with comparable hearing loss. Data from the 1977 National Health Information Survey show that about 20 percent of all hearing impaired persons over 65 used a hearing aid, compared to 4 percent of hearing impaired persons age 3 to 44 and 10 percent of hearing impaired persons age 45 to 64 (118). Among elderly people, hearing aid use increased with increasing severity of hearing impairment (see table 6).

Even though elderly people with hearing impairments are more likely to use hearing aids than younger people with similar impairments, most hearing impaired elderly people do not use hearing aids. Many reasons for this have been suggested. Some elderly people are unaware of their hearing impairments and therefore do not buy an aid. Others reject the use of a hearing aid because they associate it with getting old or becoming handicapped. Still others believe that their hearing loss is not severe enough to require the use of a hearing aid or that hearing aids are not effective for the kinds of impairments they have. Cost is an additional deterrent for some people (49).

Among those who do buy hearing aids, some are very satisfied; others are less satisfied; and some are disappointed with the aid. A nationwide survey of people of all ages who purchased hearing aids between 1983 and 1985[2] asked respondents how satisfied they were with their hearing ability with the current hearing aid. Responses are shown in table 7.

Those who answered that they were somewhat dissatisfied (6 percent) or very dissatisfied (4 percent) were asked about specific problems they experienced in using the aid. These people identified the following problems (75):

- amplification of unwanted noise,

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[2] This survey, commissioned by the Federal Trade Commission (FTC), was designed to produce a representative sample of all U.S. households and to reflect the experiences of all hearing aid purchasers nationwide (86). The FTC requested public comment on the methodology of the survey, and no serious problems in survey methods were identified by the time the public record was closed (87). Since then, analysts have pointed out that the survey might be biased because it was a mail survey and because the respondents were members of a panel of consumers who had agreed to participate in Market Facts surveys (107).

Table 6.—Persons Age 65 and Over Who Use a Hearing Aid, United States, 1977

Known hearing aid use	All levels of hearing trouble	Unilateral hearing trouble	Can hear words spoken in a normal voice	Can hear words shouted across a room	At best can hear words shouted in ear
Use a hearing aid	19.9%	10.8%	12.7%	27.5%	58.4%
Do not use an aid	80.1	89.2	87.3	72.5	41.6

SOURCE: NCHS, 1982 (118).

Table 7.—Satisfaction With Hearing Ability Using a Hearing Aid

Degree of satisfaction	Percent of all hearing aid purchasers
Very satisfied	47%
Somewhat satisfied	37
Neither satisfied nor dissatisfied	6
Somewhat dissatisfied	6
Very dissatisfied	4

SOURCE: Market Facts, 1985 (75).

- inability to hear in crowds,
- having to ask people to repeat themselves,
- feedback from the hearing aid,
- difficulty hearing phone conversations,
- friends/relatives complaining about their hearing.

Those who said they were somewhat satisfied or neither satisfied nor dissatisfied (43 percent of the total sample) were not asked about problems they experienced in using the aid. If they had been asked, they might have identified similar problems.

Dissatisfaction with a hearing aid can result from several problems: 1) deficiencies in the design and/or performance of the aid itself, 2) selection of an aid that is not well matched to the person's needs, 3) inability to adjust to the aid, or 4) a combination of all three. In many cases, it can be difficult to determine the cause of dissatisfaction.

Problems in Hearing Aid Design and Performance

The sound produced by hearing aids is sometimes described as mechanical. One reason for this is that most hearing aids amplify sound in the frequency range of 500 to 4,000 Hz, although a full frequency range from about 50 to 10,000 Hz is needed to provide reasonably accurate timbre (the quality given to sound by its overtones). In addition, hearing aids do not handle all tones evenly, resulting in further sound distortion (21).

Another problem with hearing aids is that they amplify background noise as well as speech, and users of all ages have difficulty learning to tune out distracting background noise. As a result, some hearing aid users turn off their aids in noisy environments (67). Recent changes in transducer design can intensify the speech signal in contrast to background noise and thus improve the speech-to-noise ratio (89). However, amplification of unwanted background noise remains a problem for many hearing aid wearers. For elderly people who have diminished ability to tune out background noise, this problem is particularly severe.

Since many elderly people have more severe hearing loss at high frequencies than low frequencies, uniform amplification of all frequencies is often ineffective. One approach to this problem is a *high-frequency emphasis hearing aid* that amplifies only high-frequency sounds, allowing low-frequency sounds to enter the ear without amplification (115). Another approach is *frequency lowering,* an electronic sound processing technique that lowers the frequency of received sound. This technique is in the developmental stage and sound distortions produced by the frequency lowering systems limit their effectiveness (88).

Difficulty with sound discrimination is a common element of hearing impairment in elderly people. Thus technical limitations in hearing aids that distort sound can actually worsen the hearing ability of some individuals (54). Sophisticated sound processing techniques that have been developed for military and space applications may someday be used to overcome the problems of sound distortion, background noise, and high-frequency hearing loss. Using these advanced techniques:

> . . . minute signals are successfully pried out of a profusion of far stronger noises that have often been accumulated over great distances in space. Communication in present-day air battles depends upon stunning solutions to the problem of signal (and speech) selectivity for multicommunication

> among pilots and between pilots and ground control. Such solutions employ sophisticated logic software in which the distinguishing physical characteristics of the desired signals are recognized while those of the undesired competing signals are rejected (11).

Adaptation of these techniques to hearing aid design is a high priority at the National Institute of Neurological and Communicative Disorders and Stroke and other hearing research centers across the country (81). Obstacles include miniaturization of the necessary equipment and the final cost of the device.

Several other problems can also interfere with hearing aid performance. Hearing aids need frequent cleaning and if the user does not clean the aid it will not work properly. Hearing aids can be damaged by heat and moisture, causing a need for adjustments or repair. The batteries can die, and although checking the batteries is an obvious first step for most hearing aid users, hearing specialists encounter people who complain that their hearing aids do not work, only to find that the batteries are dead. Portable battery testers are available and can help solve this problem. In the future, hearing aids could be designed with a detector circuit to sense low battery voltage and alert the user by a visual, auditory, or tactile signal. Obviously, new users need a thorough hearing aid orientation to forewarn them about these potential problems.

Problems in Selecting the Appropriate Hearing Aid

At present, there is no technique to make a hearing aid that exactly matches an individual's hearing deficits, the way eyeglass lenses are ground to match a prescription. Instead, hearing aid dealers and dispensers attempt to custom fit the aid to the individual's hearing deficit by combining and adjusting available components.

One problem faced when selecting an appropriate hearing aid is identifying the individual's precise hearing deficits. Hearing specialists disagree about what tests are needed to select a hearing aid and who is qualified to perform the tests. Audiologists are trained to evaluate hearing deficits, and some hearing specialists believe that a comprehensive audiologic evaluation is necessary to select a hearing aid. Yet many elderly individuals buy hearing aids without seeing an audiologist (10). Other hearing specialists argue that while a comprehensive audiologic evaluation is essential for diagnosing some ear diseases, only certain hearing tests are relevant to the selection of a hearing aid and these tests can be performed effectively by hearing aid dealers (62, 90, 133).

Another problem that arises when selecting an appropriate hearing aid is that little information is available comparing different brands and types of hearing aids. Hearing aid manufacturers provide technical performance data on their devices, but information about the relative merits of various brands and models is scarce.

The National Technical Institute for the Deaf and the Massachusetts Institute of Technology have designed a device to simulate the characteristics of a variety of hearing aids. This "Master Hearing Aid" provides information about the most appropriate hearing aid for the individual (19). Computer programs also have been developed to analyze audiometric data and select specific models of hearing aids that most closely match the individual's hearing deficits. Eventually, it is hoped that a computer chip programmed by a "Master Hearing Aid" could be installed in the individual's hearing aid to provide an exact match between the individual's hearing deficits and the signal processing characteristics of the aid (19). This would constitute a "prescription hearing aid." Research on various aspects of the prescription hearing aid is in progress at the Central Institute for the Deaf in St. Louis, the Lexington School for the Deaf in New York City, and other hearing research centers.

Problems in Adjusting to a Hearing Aid

Emotional and psychological factors can interfere with a person's adjustment to hearing aid use. For example, some people fail to adjust to their hearing aids because they are embarrassed by the appearance of the aid. Small, "invisible" aids are popular for this reason. Larger aids that provide better sound fidelity and are more easily manipulated by arthritic hands are sometimes rejected in favor of smaller, more expensive, and less effective instruments (10). The use of two aids, one for each ear, may also be rejected for this reason even though two aids can provide better hearing acuity for many people (134).

Unrealistic expectations can also interfere with a person's adjustment to the hearing aid. Some individuals buy a hearing aid expecting it to restore normal hearing and are disappointed with the results. This disappointment can cause significant acceptance problems (10). Research indicates that 30 percent of those who purchased hearing aids from 1983 to 1985 expected that their aids would restore normal hearing. Of these people, one-third said their hearing aids did restore normal hearing, about one-half said it somewhat restored normal hearing, and the remaining 12 percent were unsure or said it did not restore normal hearing (75).

Some people believe that elderly people have more difficulty adjusting to hearing aids than younger people because of an assumed age-related inability to adjust to anything new; however, no research justifies this conclusion. In fact, little conclusive information is available about the precise reasons why individuals of any age fail to adjust to hearing aids, and more research is needed in this area.

Anecdotal evidence suggests that some elderly people who are severely confused *and* hearing impaired may be unable to learn to use a hearing aid or even to understand its purpose. For these people, environmental design technologies and assistive listening devices that require less adjustment could be more appropriate. These approaches are described later in this chapter.

All people fitted with hearing aids need assistance adjusting to the aid. Someone must answer questions, reassure the person during discouraging periods, make needed adjustments to the hearing aid and attachments, counsel the individual and the family regarding expectations, and assist in the adaptation to environmental sounds. Otherwise, the aid will remain unused. These factors point to a strong need for competent professional involvement in the evaluation, selection and fitting, and adjustment of hearing aids (10).

ASSISTIVE LISTENING DEVICES

In addition to hearing aids, four types of assistive listening devices can be used to increase auditory effectiveness: hardwire devices, audio loop systems, radio frequency devices (AM and FM), and infrared amplification devices. These devices transmit sound directly from the speaker or other source to the listener, thus reducing interference caused by background noise. They have been used primarily in classrooms and public meeting rooms and are often referred to as "large room systems." They are now being used by some people for one-to-one or small group listening as well as TV and radio listening.

Assistive listening devices can be used by elderly people who have hearing aids and have difficulty tuning out background noise. In addition, these devices can give some elderly persons with mild to moderate hearing loss enough amplification to allow them to hear effectively without a hearing aid in some situations.

Hardwire devices provide a direct wire link between the listener and the source of sound. Examples are the earphones used with portable radios, tape players, TV, and stereos. Hearing impaired people can obtain earphones with adjustable volume. Some hardwire devices have a microphone that can be placed on a table or held by the speaker (see figure 7). Some can be used with a hearing aid. The simplicity of these devices makes them useful for radio and television listening and some one-to-one conversation, but the wire connection to the source of sound is too restrictive for many purposes.

An *audio loop system* is composed of a microphone that is worn or held by the speaker and a length of wire called an induction loop that can be installed or simply placed in a room. Sound from the microphone is converted into an electromagnetic signal that is transmitted by the loop and picked up by any hearing aid with a telephone

Figure 7.—Hardware Device for One-to-One Consultation

SOURCE: Williams Sound Corp.

switch. Loop systems can also be used by people who do not have hearing aids but wear or carry a receiver that can pick up the electromagnetic signal[3] (see figure 8). Loop systems have been used extensively in schools for the deaf and are now being used in churches, theaters, and other meeting rooms.

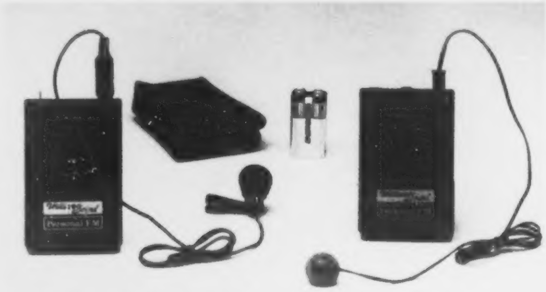
Hearing impaired people who want to use the loop system must sit within the area of the loop, but people with no hearing problems can sit in the same area. Sound quality is not always uniform throughout the area and the devices sometimes pick up interference from fluorescent lighting (103).

An *FM amplification device* is composed of a small, wireless, battery-operated FM microphone that can be placed near the source of sound (a person, television, radio, etc.) and a tiny portable stereo radio equipped with earphones that are worn by the hearing impaired person (see figure 9). Sound is transmitted from the microphone to the receiver by radio wave. The transmission range is 100 feet or more, which allows the person to move about while listening to radio, television, or conversation. Individuals with hearing aids can use FM amplification devices if their hearing aids have a telephone switch and they use a neckloop or if their hearing aids are designed for direct audio input.[4]

Figure 8.—Audio Loop Wand Receiver

SOURCE: VA Medical Center, Birmingham, Alabama.

Figure 9.—FM Personal Amplification Device: Transmitter and Receiver



SOURCE: Williams Sound Corp.

Until a few years ago, the Federal Communications Commission (FCC) limited the use of radio signals for amplification devices to educational settings. This restricted the development of FM amplification devices for personal use. Since 1982, however, changes in Federal regulations have allowed increased public access to radio frequencies. This has stimulated the development and marketing of FM amplification devices for use in the home and in public facilities such as theaters, churches, and large meeting rooms. These devices are also being used in automobiles.

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[3] In some museums, audio loop systems are used for self-guided tours for nonhearing impaired persons. The individual carries a wand receiver that is activated as he approaches an exhibit.

[4] Over-the-ear, eyeglass, and on-the-body aids that are designed for direct audio input use an adapter cord that can be plugged into the hearing aid at one end and into the FM receiver at the other end. In-the-ear aids can use a button receiver that is snapped onto the hearing aid for direct audio input.

An *AM amplification device* transmits sound using AM radio wave lengths, and the sound is picked up by a special AM receiver worn by the listener or by a portable pocket radio. The sound quality provided by AM amplification devices is usually not as good as that provided by FM devices. AM amplification devices are subject to the same sources of interference as AM radios (e.g., thunderstorms and lamp dimmers). In addition, AM devices can only be used within an area enclosed by four walls, while FM amplification devices can be used indoors and outdoors. As a result, FM amplification devices are used more frequently (103).

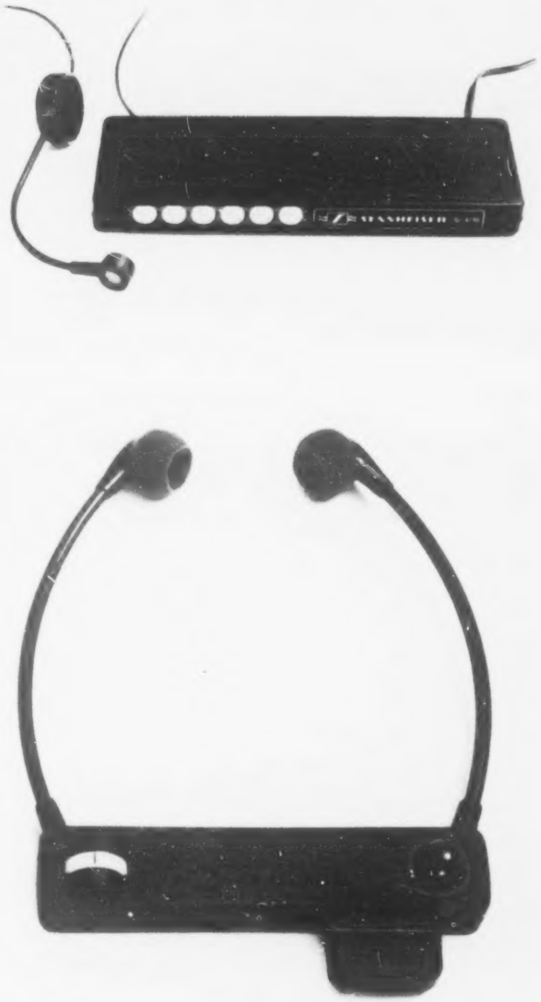
An *infrared amplification device* is composed of a battery-operated transmitter and a receiver (see figure 10). The transmitter transforms sound into an electrical signal that modulates an infrared light beam. This invisible light beam is picked up by a receiver worn by the listener (67). Infrared hearing devices are used primarily in theaters and some institutional settings, but they can also be used in the home (68).

One advantage the infrared device has over the AM and FM amplification devices is that the infrared light signal is absorbed by any opaque surface. Thus a person in one room can use an infrared amplification device to hear a speaker in that room while people in other rooms can use infrared devices to hear other speakers. There is no spillover of the infrared signal and privacy of communication is maintained. In contrast, AM and FM radio signals can radiate from one room to another. In an institutional setting or any private situation, the spillover of AM and FM signals is unacceptable (67).

One disadvantage of infrared devices is that they cannot be used in direct sunlight, and thus cannot be used outdoors like FM amplification devices. Large amounts of incandescent light in a room can also cause interference (103).

Although assistive listening devices have been used primarily to amplify sound in large rooms and public settings, they are now being used more frequently by individuals for interpersonal communication and TV and radio listening. Many applications that are especially relevant for elderly people have been suggested. For example, physicians and other professionals who talk with elderly people could have these devices available in their offices. In hospitals and nursing homes, the devices could be used by staff to communicate with hearing impaired patients, and patients could use them to listen to radio or TV without bothering other patients. Assistive listening devices could be especially helpful in banks and other offices where

Figure 10.—Infrared Amplification Device: Transmitter and Receiver



SOURCE: VA Medical Center, Birmingham, Alabama.

people communicate through glass barriers. Unlike hearing aids, no training is required to use them so they can be immediately helpful in many listening situations.

Assistive listening devices are particularly appropriate for many elderly people with mild or moderate hearing loss because these devices can provide satisfactory auditory function in some listening situations even without the use of a hearing aid. When a hearing aid is needed, assistive listening devices can help tune out bothersome background noise.

One obstacle limiting the use of assistive listening devices is the resistance many hearing impaired people feel to using devices that are visible (140). Another obstacle is lack of awareness among the hearing impaired elderly of the kinds of devices that are available. Many hearing specialists—including physicians, audiologists, and hearing aid dealers—know very little about these devices and do not encourage their use (74). Some of these specialists believe that a correctly fitted and functioning hearing aid is a better treatment option than an assistive listening device because the hearing aid does not require microphones, transmitters, or induction wires, and thus appears more "natural." Advocates of assistive listening devices point out, however, that hearing aids can be ineffective in some listening situations (102). These experts believe that until hearing aids can be designed to effectively filter out background noise, other devices are also needed.

TELECOMMUNICATION DEVICES

One of the most handicapping aspects of hearing loss for hearing impaired people of all ages is the inability to use the telephone. For the elderly, particularly those who live alone, the telephone is a link to the outside world and inability to use it can compromise safety, interfere with independent functioning, and deprive the individual of social interaction with family and friends. Anecdotal evidence indicates that when family members and friends are not able to contact the elderly hearing impaired person regularly by telephone, they become increasingly anxious about his or her welfare. In some cases, this results in suggestions that live-in help or nursing home placement is needed.

Hearing over the telephone is difficult even for those elderly people who have very mild hearing loss and are able to hear well in person. This is because telephone signals are transmitted in a limited frequency range, and very low and high frequency sounds that can be important for understanding speech are omitted in transmission. Line noises and other sound distortions also interfere with the quality of sound transmission. In the future, as the need grows to transmit more conversations over a limited number of telephone lines, this problem may become worse. Some methods for increasing line capacity involve removing parts of the speech message that are considered unimportant;[5] however, the standards for what is unimportant are based on the hearing ability of younger people with normal hearing. Research is needed to document the effect of removing parts of the speech message on the hearing ability of elderly and other hearing impaired individuals. This could be a first step toward public policy requiring transmission of telephone signals that can be heard by hearing impaired people up to a certain level of hearing loss (11).

A variety of devices are available to help hearing impaired people use the telephone. The simplest of these, which is most effective for individuals with mild to moderate hearing loss, is a volume control device that can be built into the telephone handset or attached to the side of the telephone. Portable telephone amplifiers are also available, although many elderly individuals do not know about them (see figure 11). Some research indicates that telephone amplifiers are more effective for individuals with relatively constant hearing loss across all frequencies and less effective for those with marked loss at only the high frequencies (58).

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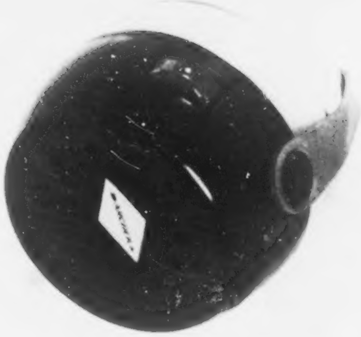
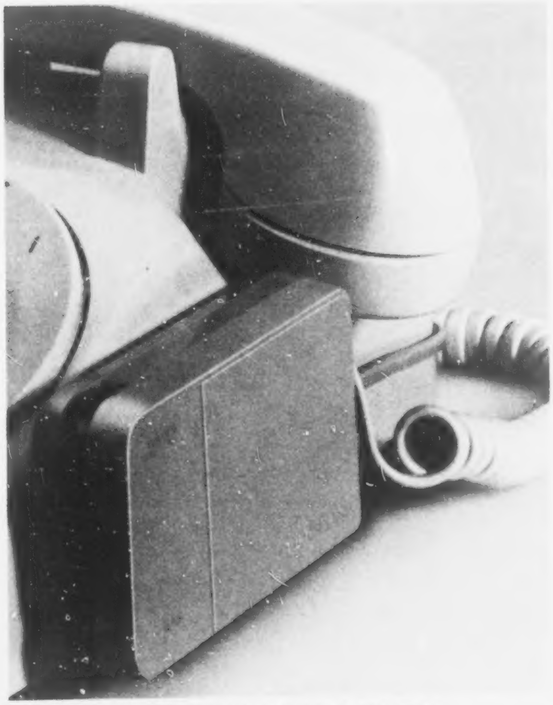
[5] These telephone engineering procedures, called "time processing," include voice switching, time division multiplex, and pulse code modulation (11).

Figure 11.—Three Types of Telephone Amplification Devices





SOURCE: Courtesy of Radio Shack, A Division of Tandy Corp.

VOLUME UP
VOLUME DOWN

SOURCE: VA Medical Center, Birmingham, Alabama.

Before the breakup of AT&T, telephone handsets with amplifiers and other specialized equipment for hearing impaired people were available through the telephone company and the cost of these devices was regulated by State public utility commissions. Following the breakup of AT&T, Federal legislation and FCC regulations allowed State public utility commissions to choose whether to regulate or deregulate this equipment (84).[6] Some States no longer regulate the cost of these devices, while others regulate all devices, or only new orders. This has created confusion for hearing impaired customers because now prices of equipment vary from State to State, the availability of equipment is uncertain, and it is often difficult to find repair service. Legislation to require State regulation of these devices was introduced in Congress in 1985 (S. 402) (91) and hearings probably will be scheduled in 1986.[7]

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[6] AT&T has created a National Special Needs Center in New Jersey and many telephone customers continue to rent or buy telephone handsets with amplifiers from AT&T.

Another device to help hearing impaired people use the telephone is the telephone switch or "T switch" on a hearing aid. The telephone switch allows the hearing aid to pick up electronic leakage from compatible telephone receivers and bypass the hearing aid microphone. Unfortunately, many hearing aids do not have telephone switches.[8] In addition, anecdotal evidence indicates that some people do not know whether their hearing aids have telephone switches, or if they do, how to use them (106). Furthermore, not all telephones are compatible with these hearing aids. The Telecommunications for the Disabled Act of 1982, which became law in 1983, requires that all telephones installed in "essential places" be compatible with hearing aids by January 1, 1985. Included as essential are public pay telephones; telephones for emergency use (e.g., on bridges, in tunnels, and along highways); and telephones in hospitals, convalescent homes, homes for the aged, and other public facilities (97). S.402, as proposed by Senator Pressler, would require that all new telephones be compatible with hearing aids.

Other telecommunication devices are available or being developed for people with severe hearing impairments. Some devices are used primarily by younger people with severe hearing impairments and may be inappropriate for many elderly persons. Telecommunication devices for the deaf (TDDs) were first developed in 1965. These devices allow users to type a message that is converted to tones and carried over a phone line. At the other end of the line, another TDD converts the message back to typewritten copy. In the past 10 years, small, portable TDDs have become available and many deaf individuals have these devices at home. Public agencies, such as fire departments, police departments, and hospitals, are being equipped with TDDs. Some communities have TDD switchboards to relay communication from people who rely on these devices to people and institutions that do not have the required equipment (10).[9]

Other devices are in the development stage, including *Teletex* and *Viewdata*. These are information retrieval systems that transmit text and simple graphics to a television receiver. Viewdata has a message service so subscribers can communicate with one another. Viewdata, if and when extensively accepted throughout the country, will provide electronic mailbox capability to both deaf and hearing people (35).

Picturephone and *Vistaphone* are devices designed to transmit a visual image of the speaker over an ordinary telephone line, thus allowing some hearing impaired individuals to communicate by speechreading or sign language. Commercial production of these devices was expected to increase use and reduce cost, but neither has caught on and there has been no support for production (35).

No data exist to show how many elderly people use or could use these telecommunication devices. Elderly individuals who have had hearing impairments since childhood or early adulthood can be expected to continue using the devices they have used throughout life. For those who become hearing impaired in old age, however, use of these devices requires both the hearing impaired person and those who communicate with him to acquire new skills. TDDs and Viewdata require users to know how to type and have the necessary equipment. The hearing impaired person must be able to see well enough to read typed messages. Picturephone and Vistaphone are only helpful to those who communicate by speechreading or sign language. Since few elderly people use these methods of communication, the usefulness of these devices is limited for them.

Computerized speech recognition systems are being developed that could greatly simplify telecommunications for hearing impaired people.

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[7] A.A. Gilroy, "Telecommunications Specialized Customer Premises Equipment for the Disabled Federal Actions Affecting Its Provision," Congressional Research Service report, Mar. 22, 1985, provides more information on the current status Federal regulations in this area.

[8] Telephone switches work best in over-the-ear and on-the-body hearing aids. It is more difficult to incorporate a telephone switch in an in-the-ear aid (97).

[9] "Selected Telecommunications Devices for Hearing-Impaired Persons," OTA background paper, 1982, reviews the history of TDDs, current problems in accessibility, and legislation affecting use (114).

These systems convert spoken words into printed output that could be displayed on a screen attached to the telephone. Since messages do not have to be typed, this system could allow much faster communication between hearing impaired individuals and between hearing and nonhearing persons.

The speech recognition systems available now have major limitations. They recognize only a few words and sometimes confuse words. Most are speaker dependent, which means that the system must be adapted to the idiosyncracies of the speech of a particular individual. Some very expensive systems (up to $35,000) offer vocabularies of 500 words, good background noise tolerance, and ability to respond to speech variations (57).

Most research on speech recognition systems is not being conducted for the benefit of hearing impaired people. It is being pursued primarily to encourage the broader use of computers by all people. However, the results of this work are likely to benefit hearing impaired people. As research continues and prices fall, these systems could provide an easier way for individuals without a hearing problem to communicate by telephone with the hearing impaired.

Closed caption television is a technology that is increasingly available to deaf and hard-of-hearing people. Captions transmitted with the television signal appear on the screen when decoded with a special device. These captions can be difficult for some elderly people to see if they also have visual impairments, but they can make television news and entertainment available to many hearing impaired elderly people. As of November 1985, 94 hours of closed caption programming were available each week. ABC provides closed captions for all its prime time programming, and NBC, CBS, and PBS each provide some closed captioned programs (79). However, the cost of a decoder ($200 to $500) prevents some elderly people from using closed caption television (10).

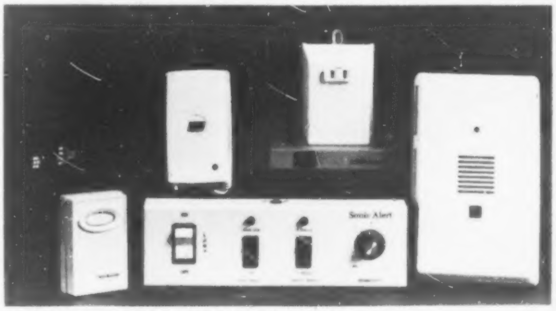
SIGNALING AND ALARM DEVICES

Signaling and alarm devices that convert sound to visual or tactile signals are important for the safety and independence of hearing impaired persons. Flashing lights or vibrating devices can substitute for the sounds of a fire alarm, smoke alarm, telephone, doorbell, or alarm clock (see figure 12). The Rehabilitation Comprehensive Services and Developmental Disabilities Amendments of 1978 requires adaptation of warning systems in public facilities, housing units, and health care facilities serving older people. Federal regulations set forth standards for audible and visual alarm systems in these facilities (10).

Tactile Paging Devices use radio signals to generate vibrations in a portable receiver carried by the hearing impaired individual. The person feels the vibrations and can respond to the signal. The devices can be used to contact the individual within a one-quarter mile radius of the transmitter.

These devices can be used alone or combined with a hearing aid or other assistive listening devices and telecommunication devices. A combination of devices can compensate effectively for most hearing impairment in elderly people. But these devices cannot be useful to hearing impaired elderly people unless they know such options exist. While information generally is available in the deaf community, elderly people are seldom part of this group. Since elderly people seldom receive comprehensive aural rehabilitation services, they do not learn about devices from hearing specialists.

Figure 12.—Sonic Alert Signaling System, Including a Paging Device and Door Bell Signaler



SOURCE: VA Medical Center, Birmingham, Alabama.

Public information about available devices and treatment options almost always focuses on "new" and dramatic approaches. For example, cochlear implants are now receiving considerable coverage although very few patients have received them. The emphasis on revolutionary breakthroughs in medical and surgical treatment distracts attention from the far less dramatic rehabilitative procedures and devices that could benefit the majority of hearing impaired elderly people (10).

Advertising by hearing aid manufacturers and distributors has been an important source of public information about hearing loss and hearing aids. While it undoubtedly contributes to public awareness and greater acceptance of hearing aids, advertising is selective and does not give equal weight to all treatment options (10). Chapter 4 discusses some alternate methods for increasing people's awareness of the many devices available.

ASSISTIVE DEVICE DEVELOPMENT

In the United States today, assistive devices for hearing impaired people are developed by:

- universities and colleges for the deaf;
- universities and colleges with rehabilitation training programs and/or speech and hearing clinics;
- Rehabilitation Engineering Centers for the Hearing Impaired, funded by the National Institute for Handicapped Research;
- the Veterans Administration,[10] Department of Defense, and other agencies of the Federal Government that offer rehabilitative services and are also engaged in the development of assistive devices;
- laboratories of commercial firms;
- independent inventors and entrepreneurs; and
- the Small Business Innovative Research Initiative of the National Institutes of Health.

With few exceptions, the major financial responsibility for research and development of hearing aids and innovative devices for hearing impaired people has been borne by commercial manufacturers. Although competition among manufacturers has brought some achievements, there have also been problems. For example, miniaturization of hearing aids has improved their marketability but it also sometimes reduces performance (54, 60). Furthermore, relatively little effort has been made to develop highly specialized devices that benefit only a small number of people because the potential market is limited (10).

Problems in developing and disseminating all kinds of assistive devices for handicapped people are discussed in a 1982 OTA report, *Technology and Handicapped People*. Problems that limit development and dissemination of devices for elderly people are discussed in a 1985 OTA report, *Technology and Aging in America*. Many of the problems discussed in these reports affect the development of devices for hearing impaired elderly people. For example, it is often difficult to identify potential users, and small companies—frequently the source of innovative products—lack financial and staff resources to launch a marketing campaign to reach these people. Without an identifiable market, companies are reluctant to invest in research, development, and manufacture of new devices. Lack of third-party reimbursement for devices and erratic funding guidelines by public programs that pay for these devices also limit the market.

In some industrial countries, such as Sweden, the development of assistive devices is considered a government responsibility. Public funding is provided not only to develop and manufacture devices, but also for distribution and repair. In the United States, where distribution of assistive devices has been left primarily to the private sector, lack of an identifiable market discourages development of these devices (10).

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[10] The VA program of medical device development and testing is the topic of a 1985 OTA report, *Medical Devices and the Veterans Administration*. This report discusses VA policies for research and device development for all kinds of medical conditions, including hearing impairment.

ENVIRONMENTAL DESIGN

Building design characteristics affect the behavior of sound and the relative ease or difficulty of hearing. For example, hard-surfaced walls and floors reflect sound, creating reverberations that interfere with hearing, while sound absorbent wall-covering materials decrease reverberations (66). Attention to the acoustic characteristics of buildings could decrease the impact of hearing impairment for people of all ages.

Background noise is a major impediment for hearing impaired individuals, regardless of whether they use hearing aids. Proper planning and building design can help limit unnecessary background noise. For example, in a nursing home or congregate housing facility the dining room should not be located between a noisy kitchen and a noisy laundry room or mealtime conversation will be difficult for hearing impaired residents. Daily events should be scheduled to account for the problem of background noise. Thus, vacuuming and other noisy activities should not be scheduled when residents are involved in a discussion group.

Room arrangement and lighting can also affect hearing. In a large room where several conversations may occur at once, space dividers that absorb sound can create a sense of privacy and decrease ambient noise levels that interfere with hearing (52). Similarly, good lighting and an unobstructed view of a speaker can facilitate use of speechreading techniques (73). While much is known about design characteristics that affect hearing, this knowledge has not been widely applied. Relatively inexpensive measures that reduce reverberations and background noise in buildings used by elderly people could benefit many people with hearing loss.

AURAL REHABILITATION

Few hearing impaired elderly people receive aural rehabilitation services. Yet these services can be an important part of treatment. Some aural rehabilitation services, such as auditory training and speechreading, are primarily provided by audiologists, if at all. Other services, such as hearing aid orientation, can be provided by both audiologists and hearing aid dealers.

Sign language is taught to many younger persons with severe hearing impairments, but it is not widely used by the elderly for several reasons. First, it is difficult for elderly people who develop hearing loss late in life to learn a completely new language. In contrast, many younger people with severe hearing impairments have used sign language since childhood.[11] Young people with severe hearing impairments often attend school and interact with other severely hearing impaired people who use sign language. Thus, they develop a network of friends and associates who communicate by sign language. In contrast, the friends and associates of elderly people who become hearing impaired late in life seldom know sign language. Finally, hearing impaired elderly people usually retain some residual hearing and other methods to maximize residual hearing can be more effective and more acceptable than sign language (136).

Hearing Aid Orientation

Hearing aid orientation can help people overcome problems that interfere with the successful use of the aid. The user needs instruction in the care and maintenance of the aid and earmold, an opportunity to practice inserting the earmold and batteries and changing volume controls, and advice and encouragement about gradually increasing the use of the hearing aid in a variety of listening situations (10).

Unrealistic expectations about the ability of a hearing aid to restore normal hearing can interfere with adjustment to the aid for some people.

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[11] Hearing specialists who treat young persons with severe hearing impairment disagree about whether sign language or an alternative procedure for understanding normal speech, such as speechreading and Cued Speech, is the best method of communication (37). This controversy applies primarily to young people and is not discussed in this report.

Hearing aid orientation should begin before the aid is purchased and provide information about problems that can be expected and the need for training. It should also continue after the aid is purchased. All users should return to the hearing aid dealer or audiologist for a followup check on the functioning of the aid and the individual's adjustment to it.[12]

Auditory Training

Intonational patterns created by variation in the pitch, intensity, and duration of sound give clues about the content and meaning of speech. Auditory training teaches the individual to use these clues to supplement his residual hearing. The person learns to recognize and differentiate sounds by practicing with live or recorded sounds (136). Auditory training now is used almost exclusively with hearing impaired children. But the elderly, who usually have some residual hearing, can also benefit and some auditory training programs include elderly people.

Speechreading

Speechreading is the use of visual cues to facilitate the understanding of speech. The hearing impaired person is taught to recognize lip, facial, throat, and body positions and movements involved in speech production (26, 96). Few elderly individuals are taught speechreading techniques, although these techniques can be particularly effective for people who have only partial hearing loss, including those who use a hearing aid.

Negative attitudes about the rehabilitation potential of elderly people among elderly individuals themselves, their families, and health and social service professionals contribute to the failure to offer training in speechreading. It is often assumed that most elderly people are not willing or able to learn speechreading. Clearly this assumption should not go unchallenged when training has not been offered to many of those who might benefit from it.

Cued Speech is a system of communication that supplements speechreading and is being used with elderly people in a few places in the United States. Developed by R. Orin Cornett, Cued Speech involves the use of eight hand shapes that clarify consonant sounds and four hand positions that clarify vowel sounds. For example, the words "mit," "bit," and "pit" are virtually indistinguishable with only speechreading techniques. Cued Speech uses a hand signal to designate which consonant is being spoken (136). Cued Speech differs from sign language in that it clarifies spoken language rather than replacing it with manual communication (36).

To use Cued Speech, the hearing impaired individual and others who want to communicate with him must learn the hand signals and positions. This takes up to 20 hours for most adults, plus extensive practice. Learning requires motivation and Cued Speech trainers have noted that some family members are reluctant to learn this new communication technique. While very few elderly people have been taught Cued Speech thus far, those who do master it report great satisfaction with their renewed ability to communicate clearly using normal spoken language (136).

Microelectronic aids to speech comprehension such as visual and tactile devices may soon be available. For example, the Upton eyeglass speech reader projects voice-spectrum information onto the wearer's eyeglasses to augment speechreading. Although the display of speech-sound categories are far from error free, some information of modest consistency is better than no information at all. Some design improvements are necessary before the Upton system is ready to be field tested (88).

An automatic cuer has been developed by R. Orin Cornett and Robert Beadles as an aid to Cued Speech. This device, the "Autocuer," uses a microprocessor to classify speech into cue groups and activate 56 tiny light-emitting diodes on the user's eyeglasses (39) (see figure 13). A 1-year trial of the Autocuer using children and adults was scheduled to begin in 1985 (99).

Vibrating devices that give cues to facilitate speechreading are also being developed. One example is the "Teletactor belt," which is worn around the abdomen and produces vibrations that are felt as a tickling sensation by the user. Different sounds cause distinctive patterns of vibrations that the individual must learn to recognize (15).

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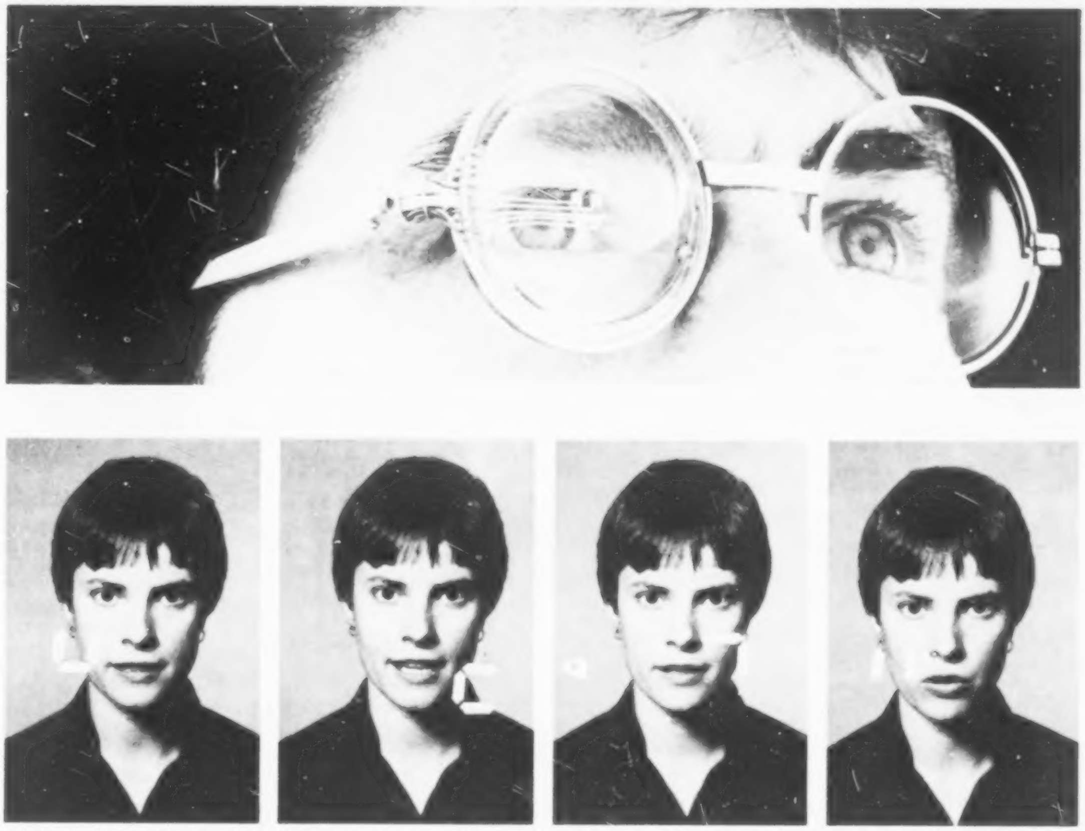
[12] Some dealers and audiologists include the cost of a followup check in their initial price, while others charge extra for it (104).

Figure 13.—Lip Reading Glasses



As illustrated in these photographs, different sounds are difficult to distinguish using only visual cues. The "Autocuer" is designed to help speech readers distinguish sounds that appear similar. A microphone on the glasses frame picks up the voice as much as 12 feet away and transmits it to a microprocessor that analyzes the sound and relays signals back to light-emitting diodes on the glasses lens. The diodes produce an image that represents the sound. The series above shows the images that represent the sentence He can go.

SOURCE: Research Triangle Institute, RTI Park, North Carolina.

The inventor of this device, Frank Saunders, has received a Small Business Innovative Research Initiative award from the National Institutes of Health to develop it; it is being tested for efficacy in middle aged and elderly people (59).

Some hearing researchers believe that tactile stimulators will be most useful for people with some residual hearing who use the sensations to enhance speechreading (60). Others believe that people who have lost their hearing after learning to speak will probably never be able to learn to use the vibratory cues effectively and that the devices will be most useful to the prelingually deaf (25).

These electronic speechreading aids are in the development stage. Furthermore, each will require users to undergo substantial training. When they become available, their advantage over current speechreading techniques will be that they provide cues to differentiate sounds that are visually identical. Their advantage over Cued Speech will be that the hearing impaired individual will be able to communicate with anyone in any setting, without depending on the speaker's ability to cue.

Counseling

Counseling can help hearing impaired people overcome negative attitudes that interfere with rehabilitation and develop strategies to manage listening situations in ways that lessen their disability (26). Problems that interfere with the rehabilitation of hearing impaired elderly people include: 1) physical conditions such as poor vision, arthritis, limited manual dexterity, and limited mobility; 2) lack of motivation and a sense of hopelessness; and 3) cost factors. Counseling can be effective in addressing each of these problems.

Physical impairments that are common among elderly people can interfere with aural rehabilitation. For example, the elderly person with reduced visual acuity may be unable to see well enough to use speechreading techniques. Individuals with arthritis may be unable to insert a hearing aid earmold properly due to reduced mobility of the shoulder or manual dexterity (10). Similarly, those with diabetes or other conditions that decrease sensitivity in their fingers may have trouble inserting the earmold and adjusting the aid. The total physical condition of the individual should be evaluated before an appropriate treatment is recommended. Counseling can help develop methods for overcoming the obstacles that hinder treatment.

Lack of motivation and a related sense of hopelessness also interfere with aural rehabilitation. Elderly people are particularly likely to believe that nothing can be done to correct their hearing problems. This belief is exacerbated by society's negative attitudes about the rehabilitation potential of elderly people. Some elderly individuals have been known to suggest that services be directed toward a younger person who could derive greater benefit. Denial of hearing impairment also limits motivation (1).

A first step in dealing with lack of motivation is to understand the meaning of the hearing loss to the individual, the situations in which he/she has difficulty hearing, and how important these situations are to him/her (96). Second, the rehabilitation process should be adapted to the needs and abilities of the individual. Healthy, active elderly people may be capable of obtaining services provided in the community. However, others with financial or health-related problems are often unable or unwilling to seek out such services and an outreach program may be needed (26). Diagnostic and rehabilitative services could be provided in the person's home, a senior center, or a nursing home. Hearing specialists also could provide in-service education to the individual's caregivers (family, day program counselors, nursing home staff, etc.). Including "significant others" in the rehabilitative process enhances the hearing impaired individual's chances of success.

Obstacles to the increased use of aural rehabilitation services, hearing aids, assistive listening devices, and telecommunication, signaling and alarm devices include problems in the service delivery system (ch. 4) and lack of funding (ch. 5). Whether an elderly person elects to seek aural rehabilitation or fitting for amplification devices often depends on financial status and the relative value he places on communication compared to other products and services he needs.

Chapter 4

The Service Delivery System

Chapter 4

The Service Delivery System

The existing service delivery system[1] does not provide access to optimal treatment, devices, and services for many hearing impaired elderly people. Listed below are some of the most common problems that need to be addressed:

- Some hearing impaired elderly people are never evaluated by a hearing specialist. Data from the Health and Nutrition Examination Survey, collected from 1971 to 1975, showed that 61 percent of elderly people with significant hearing impairments had never had any audiometric testing. Low-income elderly people were particularly unlikely to have been tested (50).
- A 1984 survey showed considerable improvement in this problem over the past decade. However, of the 16 million people with hearing impairments in the United States, about 3.7 million (23 percent) have not seen a hearing specialist even though they are aware of their hearing impairment. Another 2 million (12.5 percent) are unaware of or deny that they have a hearing impairment (49). No age breakdown is available for these data.
- At least 75 percent of all hearing impaired people do not own a hearing aid, and some people buy hearing aids that are not well matched to their needs.
- Some elderly people who have had a hearing aid and/or a hearing evaluation in the past refuse further evaluation and treatment because they were disappointed with the previous experience (73).
- Many elderly people are not aware of available assistive listening devices, telecommunication devices, and signaling and alarm systems.
- Few elderly people receive aural rehabilitation services despite the potential benefit of these services.

The service delivery system involves three types of hearing specialists—physicians, audiologists, and hearing aid dealers—each with a substantially different orientation to hearing impairment. Although there are always exceptions to any generalization, it can be said that physicians generally approach hearing impairment from a medical point of view and their primary objective is curing or ameliorating disease in their patients. Audiologists generally approach hearing impairment from a service point of view and their primary objective is assessing the individual's communication deficits and recommending or providing services and devices to improve communication ability. Hearing aid dealers generally begin from a business point of view and their primary objective is providing an effective and satisfactory product for their customers. An increasing number of audiologists are now selling hearing aids, and these "dispensing audiologists" can be expected to share attitudes and objectives with both hearing aid dealers and audiologists.

These differences in points of view and objectives among the three types of hearing specialists can lead to disagreement. What is the best form of treatment for hearing impaired people? Which hearing specialist should a person see first? Should one type of specialist coordinate or supervise hearing services provided by other specialists? Changes in patterns of patient referral and treatment have both theoretical significance and financial implications for each type of hearing specialist. As a result, rivalry among them has been intense at times. This rivalry has been and will continue to be exacerbated-whenever proposed Federal legislation and regulations appear to designate one type of specialist as the primary provider of hearing services.

The rivalry among hearing specialists contributes to fragmentation of delivery system and results in a lack of continuity of care. A client who is unaware of the differences between the three types of hearing specialists must often seek out services on his own. Frequently, each type of hearing specialist works in a different setting and clients must make numerous trips to obtain all the necessary services. This is particularly difficult for many elderly people.

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[1] As used in this report, the term "service delivery system" refers to service providers, referral patterns, and the settings in which hearing services are delivered.

These problems have been solved in some hospital- and university-based speech and hearing clinics that combine medical and audiological services and the capacity to dispense hearing aids and other devices. The Veterans Administration (VA) also has a comprehensive delivery system. In addition, a growing number of hearing specialists are setting up private practice groups that provide a full range of hearing services in one setting. Finally, the professional societies that represent each type of hearing specialist have sponsored programs at the national, State, and local level to increase communication and cooperation among the providers of hearing services. Continued efforts to coordinate the delivery of hearing services would benefit hearing impaired people of all ages.

SERVICE PROVIDERS AND REFERRAL PATTERNS

Physicians, audiologists, and hearing aid dealers are the principal providers of hearing services. Speech therapists, social workers, psychologists, nurses, and other health care and social service providers are sometimes involved in referring the elderly for hearing evaluation and treatment.

Physicians

Many elderly persons enter the service delivery system via a primary care physician, such as a general practitioner, family practitioner, or internist.[2] Some individuals are referred by the primary care physician to another physician who specializes in diseases of the ear—usually an otolaryngologist or otologist.

Otolaryngology is a medical/surgical specialty, requiring 5 years of specialty training in the diagnosis and medical/surgical treatment of conditions affecting the ear, nose, throat, head and neck, and facial, cosmetic, and reconstructive plastic surgery. Otolaryngologists also receive some training in hearing measurement and aural rehabilitation. An otologist is a board certified otolaryngologist who chooses to limit his practice to medical/ surgical treatment of diseases of the ear.

Some hearing specialists believe that the first step in the delivery of hearing services should be an evaluation by a physician, specifically an otolaryngologist or otologist, and that the physician should supervise treatment. Physician involvement is seen as essential because the physician is the only hearing specialist who can diagnose diseases that cause hearing loss (62, 42). Even though few of the hearing impairments common among elderly people are medically treatable, prompt identification of those few is clearly important. In addition, hearing impairment is sometimes the earliest symptom of serious pathology, such as an acoustic tumor, that requires immediate medical attention (10).

Physicians, including otolaryngologists, otologists, general practitioners, internists, and others, often play a key role in determining which hearing services are provided for elderly people. Private insurance and government funding programs often require that a physician approve hearing services as a condition of payment. Yet physicians who do *not* specialize in diseases of the ear generally receive very little training about auditory problems and almost no training in the management of auditory impairments that are not medically treatable. As a result, many of these doctors lack the expertise necessary to identify the hearing services needed by most elderly people (10).

Some hearing specialists express similar reservations about the role of otolaryngologists and otologists in determining what hearing services are provided for elderly people. These people argue that although otolaryngologists and otologists are the acknowledged experts in diagnosis of ear diseases, they are primarily trained in medical and surgical treatment and therefore are not well-qualified to advise hearing impaired adults about hearing aids and alternative approaches to compensate for hearing loss (33). It is said that they are particularly unlikely to know about assistive devices, telecommunication devices, and signaling and alarm systems (108).

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[2] Although no data are available, anecdotal evidence indicates that only a small proportion of primary care physicians include a hearing test as part of a regular physical examination (106). Thus, it is likely that most of the elderly people who discuss their hearing with a primary care physician initiate the discussion themselves, or it may be brought up by a family member.

In contrast, others argue that otolaryngologists receive substantial training in amplification and management of hearing impairment. The American Academy of Otolaryngology-Head and Neck Surgery also provides postgraduate education programs and self-instructional courses for physicians on the rehabilitation of hearing impaired people (43). It is interesting to note that a Federal Trade Commission survey of people who purchased hearing aids from 1983 to 1985 found that 6 percent purchased their aids from a physician (75). Some observers believe that the number of physicians who dispense hearing aids is increasing and that this trend will continue (106).

Audiologists

Audiologists are nonmedical hearing specialists trained in the identification, measurement, and rehabilitation of hearing impairment. Audiologists take courses in speech, hearing, and language mechanisms, culminating with a master's or doctoral degree in audiology. Many also hold a Certificate of Clinical Competence from the American Speech-Language-Hearing Association (ASHA). The practice of audiology is currently licensed in 35 States, and State licensing requirements are generally as rigorous as those for the Certificate of Clinical Competence (10).

Evaluation by an audiologist includes an assessment of hearing threshold sensitivity, speech discrimination ability, and residual peripheral and central auditory function. While audiological testing often reveals information that is useful to physicians in establishing a medical diagnosis, the primary purpose of the audiologic assessment is to determine the impact of impaired hearing on a person's total communication ability. The assessment usually includes a comprehensive history covering:

- the onset and development of the hearing impairment;
- its relationship to physical, social, and emotional well-being;
- previous treatment;
- the relationship of the hearing impairment to other sensory or perceptual dysfunctions; and
- the effect of the hearing impairment on the person's speech (10).

Some hearing specialists argue that a comprehensive audiologic assessment is needed to determine the potential benefit of a hearing aid, the type of hearing aid that is needed, whether the fitting should be monaural or binaural, and which ear should be fitted (10). Others argue that parts of the audiologic assessment are not relevant to determining the potential benefit or selection of a hearing aid and that these tests can be unnecessary, time-consuming, and expensive for some hearing impaired people (62, 90, 133).

Until recently, audiologists did not sell hearing aids. There was a commitment to establish audiology as a profession that would provide hearing services, not products, and as a scientific discipline that would not be involved in commercial activities (41). The practice of audiology has changed considerably in recent years, however, and 35 to 40 percent of audiologists now sell hearing aids (18).[3] Some analysts believe that the traditional commitment of audiologists to remain uninvolved in commercial aspects of hearing aid sales has resulted in skeptical or negative attitudes about hearing aids among some audiologists and that they may, therefore, fail to recommend a hearing aid even when the aid might benefit the patient (41).

Some audiologists sell assistive listening devices and telecommunication, signaling, and alarm devices. Survey data indicate that these devices account for about 2 percent of the gross profits of dispensing audiologists (23). Other audiologists provide clients with information about these devices, but do not sell them. Still others neither sell nor provide information about them, and some are not knowledgeable about them. Few professional training programs for audiologists include courses on assistive devices and the certification program for audiologists administered by ASHA does not require comprehensive training about these devices (33). Training programs such as those developed by Vaughn and Lightfoot of the VA Medical Center in Birmingham, Alabama, described later in this chapter, are designed to inform audiologists and other hearing specialists about these devices. In addition, ASHA has sponsored training workshops for audiologists on assistive listening devices.

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[3] Audiologists who dispense hearing aids are subject to any relevant State regulations. In some States, licensed audiologists are required to take a hearing aid dealer's exam to dispense hearing aids, while in other States they are exempt from this requirement. Some States require that audiologists complete an apprenticeship under the supervision of a licensed hearing aid dealer, while others do not. These variations in regulations can cause confusion and tension between audiologists and hearing aid dealers and impede reciprocity agreements between States (10).

Most audiology training programs have not emphasized the special problems of hearing impairment in elderly people. However, ASHA has recently developed a model curriculum for this purpose.

Hearing Aid Dealers

Hearing aid dealers sell hearing aids and hearing aid accessories, such as batteries, tubing, and earmolds. Hearing aid dealers do not have lengthy formal education in hearing impairment like otolaryngologists, otologists, and audiologists. Yet many have considerable experience and expertise in the remediation of hearing loss. They are generally well qualified to select and fit hearing aids, make earmold impressions, and instruct people in the use and care of hearing aids. Many dealers also repair hearing aids. Both hearing aid dealers and audiologists provide hearing aid orientation. All three types of hearing specialists provide counseling for hearing impaired people, although the focus and content of counseling may differ substantially depending on who provides it.

Hearing aid dealers have been harshly criticized in the past. Other hearing specialists and some consumer advocates have charged that hearing aid dealers focus too much on sales, that their sales tactics are too aggressive, and that they are not adequately trained to evaluate hearing impairment. The National Hearing Aid Society (NHAS) offers a 20-week home-study course for hearing aid dealers, but the course has been criticized as inadequate, incorrect, and outdated (10, 126).

Despite these criticisms, a recent nationwide survey showed that 72 percent of the people who bought hearing aids from hearing aid dealers were satisfied and would return to the same dealer. Only 16 percent would not return to the same dealer, and 12 percent were undecided. Consumer satisfaction with hearing aid dealers was lower than satisfaction with dispensing physicians and audiologists, however; 78 percent of those who bought a hearing aid from a physician and 81 percent of those who bought an aid from an audiologist said they would return to the same seller (75). While the validity of the sampling procedure for this survey has been questioned (107), and consumer satisfaction was greater among those who purchased aids from physicians and audiologists, these data do indicate considerable satisfaction with the performance of hearing aid dealers.

Hearing aid dealers are the only hearing specialists available in some geographic areas, and as such they provide hearing services to people who would otherwise have no access to services. In addition, it is likely that over the years hearing aid dealers as a group have had more experience with *elderly* hearing impaired people than other hearing specialists. Their understanding of the practical realities of providing amplification for elderly customers—problems of acceptance and adjustment and the kinds of listening situations that are particularly difficult for elderly people even with a hearing aid—could be a valuable source of information about the physical and psychological aspects of hearing loss in elderly people.

Hearing aid dealers are licensed in 45 States. A substantial number of dealers are also accredited by NHAS and/or the National Board for Certification in Hearing Instrument Sciences. NHAS has conferred the title "certified hearing aid audiologist" on dealers who pass the NHAS home-study course. Audiologists object to the use of this title by hearing aid dealers, saying that it can be confusing to consumers because it implies that the dealer possesses expertise which he does not have (10). ASHA has recently won a U.S. Patent Office ruling that only audiologists can use the word "audiologist" in their title. NHAS has appealed this ruling (133).

Most hearing aid dealers do not sell assistive listening devices or telecommunication, signaling, and alarm devices. These devices account for less than 1 percent of the gross sales of hearing aid dealers (23). Some hearing aid dealers do not sell these devices because they believe that assistive listening devices are a low-cost alternative to hearing aids and could therefore reduce hearing aid sales. The profit to the dealer on assistive devices is generally less than on hearing aids. Some dealers also complain that they do not have enough space to display the devices. Others may not know about available devices (33, 68, 74). Yet interest in these devices is increasing and some observers believe that more hearing aid dealers and dispensing audiologists will begin to offer them in the near future (29, 74).

Referral Patterns

Elderly people with hearing impairments can enter the service delivery system through a primary care physician, a physician specialist, an audiologist, or a hearing aid dealer. Each hearing specialist can provide services himself and/or refer the person to one or more other specialists. In one pattern of service delivery, the point of entry is a primary care physician, who may treat the individual, refer him directly to an audiologist or hearing aid dealer, or refer him to an otolaryngologist or otologist. The otolaryngologist may conduct hearing tests in his office or refer the patient to an audiologist for testing. When testing indicates sensorineural or other irreversible hearing loss, the otolaryngologist may refer the patient directly to a hearing aid dealer or he may refer the person to an audiologist for assessment of the potential benefit of hearing aid use, selection of the appropriate instrument, and other rehabilitative measures. The audiologist may supply the hearing aid or refer the patient to a hearing aid dealer (10).

A second pattern of service delivery involves entry through the audiologist or audiology clinic. If the initial audiologic evaluation suggests the possibility of medically significant pathology, the individual is referred to a physician, usually an otolaryngologist. When no such pathology is apparent, the audiologist proceeds with hearing aid evaluation and aural rehabilitation services. If a hearing aid is recommended, it may be dispensed by the audiologist or the individual may be referred to a hearing aid dealer (10).

In a third pattern of service delivery the hearing aid dealer is the point of entry, with contact initiated by the consumer or as a result of solicitation by the dealer. The dealer may refer the consumer to a physician or an audiologist for medical or audiologic evaluation, or he may dispense the hearing aid on the basis of his own evaluation (10).

Federal Food and Drug Administration (FDA) regulations require that hearing aid purchasers must present a written statement from a licensed physician to the dealer or dispenser, dated within the previous 6 months, certifying that their hearing loss has been evaluated by the physician and that the individual is a candidate for a hearing aid. However, people over 18 years of age can sign a form waiving the requirement for a physician's evaluation (10). No information is available about how many hearing aids are sold on the basis of these waivers. However, only 42 percent of those who bought hearing aids from 1983 to 1985 recalled being told about the requirement of a physician's evaluation or a signed waiver, 46 percent said they had not been told about the requirement, and 12 percent could not remember (75).

Many physicians and audiologists are concerned that people who see a hearing aid dealer first frequently are not referred to a physician for medical evaluation or to an audiologist for comprehensive audiologic evaluation. Although data on referral patterns are not conclusive, a nationwide survey of people who purchased hearing aids from 1983 to 1985 indicates that 64 percent of respondents saw a physician about their hearing problems before purchasing a hearing aid. Of these individuals, 92 percent saw an ear specialist and 15 percent saw a general practitioner or internist. Clearly, some individuals saw both (75).

Survey data also show that about 45 percent of respondents received information about hearing aids from an audiologist prior to purchasing an aid and 53 percent said that an audiologist recommended the performance characteristics for their aid (75). Thus at least half of those who purchased a hearing aid had seen an audiologist before buying the aid.

Anecdotal evidence suggests that some people who are referred by a hearing aid dealer to a physician or audiologist for evaluation prior to purchasing a hearing aid are not referred back to the dealer to buy the aid (133). In some cases, the physician or audiologist may recommend against purchasing an aid, while in other cases the person may purchase the aid from the audiologist or a different dealer recommended by the physician or audiologist. Obviously, alleged instances of the latter type are troublesome to hearing aid dealers.

Also troublesome to dealers is the finding that physicians and audiologists often recommend against hearing aids for people who, in the opinion of the dealer, would benefit from using an aid. One national survey showed that among hearing impaired people who do not own hearing aids, 63 percent have discussed their hearing problems with a hearing specialist. Of those who saw an otolaryngologist or otologist, 34 percent received a recommendation against buying a hearing aid. Of those who saw an audiologist, 27 percent received a recommendation against buying an aid (49). While no information is available about whether hearing aid dealers would recommend hearing aids for all of these people, it is clear that there is disagreement among hearing specialists about who can benefit from a hearing aid.

This information about hearing specialists, referral patterns, and recommendations about hearing aid use raises many questions about the most appropriate hearing services for hearing impaired elderly people. For example:

- Is physician evaluation essential for all elderly hearing impaired people?
- Should a physician, or a physician who specializes in ear diseases, supervise all hearing services?
- Is a comprehensive audiologic evaluation necessary for all elderly hearing impaired people?
- Which hearing tests are necessary to determine the potential benefit of a hearing aid and/or to select the appropriate aid?
- Are there categories of individuals with partial hearing loss who cannot benefit from a hearing aid? If so, can these categories be agreed on by the three types of hearing specialists?

These questions relate both to the quality of hearing services and to their cost, and hearing specialists disagree strongly about the relative merits of different patterns of service delivery.

This OTA report reaches no conclusions about these important questions or the relative advantages of different patterns of service delivery. The two nationwide surveys of the service delivery system that have been cited throughout this report (49, 75) provide valuable information about the existing service delivery system. Further research is needed to determine the costs and benefits of alternate patterns of service delivery. Such research would require a prior determination of which hearing services are essential and/or desirable for elderly people—a determination that can best be made by drawing on the expertise and experience of all three types of service providers. It is possible that the Federal Government could initiate or support a joint effort of this kind.

The Role of Other Health Care and Social Service Providers

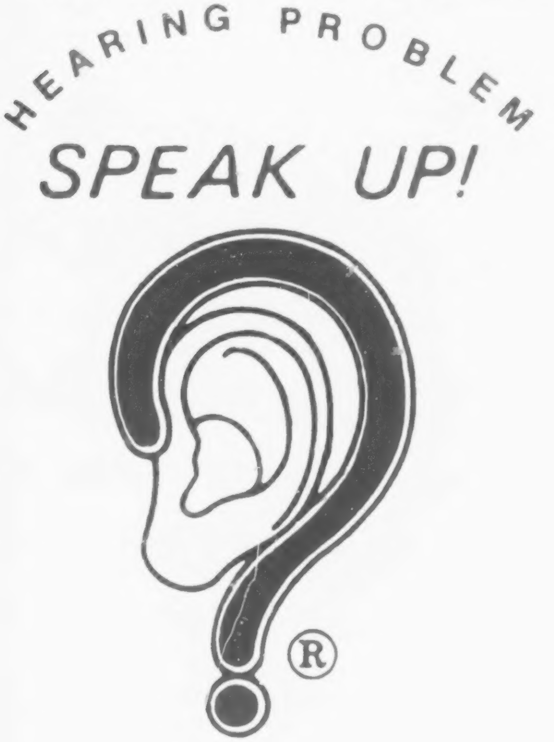
Speech therapists, social workers, psychologists, nurses, and other health care and social service professionals also provide advice, referrals, and emotional support to hearing impaired elderly people. Unfortunately, many of these professionals know very little about hearing impairment or available treatments, devices, and hearing services. *All* health care and social services professionals should be educated about hearing impairment and appropriate procedures for referring people to hearing specialists (10). Training materials are also needed for health care and social service providers who have completed their professional education.

ASHA received a grant from the Administration on Aging to develop training materials for hearing specialists and other health and social service providers who work with elderly people. One example of such materials is the recent ASHA and the National Information Center on Deafness publication *Hearing Loss: Information for Professionals in the Aging Network* (137).

The Suzanne Pathy Speak-Up Institute, based in New York City, has developed a program to train hospital personnel to recognize and respond effectively to hearing impaired patients. Hospitalization is an anxiety-producing experience for most people. For hearing impaired elderly people, hospitalization can be especially frightening because they are often unable to hear instructions and explanations given by nurses, physicians, and other hospital personnel. The National Center for Law and the Deaf points out that when patients cannot hear explanations of their condition and proposed treatment, their "informed consent" could be considered legally invalid. In addition, there is a risk of wrong diagnosis for patients who cannot completely understand questions about their symptoms and consequently provide inaccurate information to the physician (80).

The Suzanne Pathy Speak-Up program provides stickers to mark patient charts and instruction cards to remind staff how to communicate with hearing-impaired patients (see figure 14). As of July 1984 the program was in effect in more than 50 hospitals across the country (110) and is being extended to home health care agencies (85).

Figure 14.—Materials Supplied to Participating Hospitals by the Suzanne Pathy Speak-Up Institute



RULES TO REMEMBER WHEN SPEAKING TO SOMEONE WITH A HEARING LOSS:

- DO NOT SHOUT.
- SPEAK CLEARLY AND SLOWLY.
- REPHRASE A MISUNDERSTOOD SENTENCE.
- MOVE AWAY FROM BACKGROUND NOISE.
- STAND IN CLEAR LIGHT FACING THE PERSON WITH WHOM YOU ARE SPEAKING.
- DO NOT OBSCURE YOUR MOUTH WITH A CIGARETTE OR HANDS AND DO NOT CHEW FOOD WHILE SPEAKING.
- ASK THE PERSON WHAT YOU MIGHT DO TO MAKE CONVERSATION EASIER.

THE SYMBOL OF THE SPEAK-UP INSTITUTE

To increase awareness of hearing impairment, the Suzanne Pathy Speak-Up Institute has developed this large sign to place above the bed of the hearing impaired patient. Smaller gummed stickers are also available to mark the medical chart of each hearing impaired patient. They also supply a gummed card for the medical chart of each patient to remind hospital staff of rules for communicating with the hearing impaired.

SOURCE: Suzanne Pathy Speak-Up Institute.

SETTINGS FOR SERVICE DELIVERY

Most hearing services for elderly people are provided in the offices of physicians, audiologists, and hearing aid dealers. To a lesser extent, hearing services are also provided in health care and educational settings and in multi-service community agencies. Although certain services, such as medical and surgical treatment, can only be provided in health care settings, others such as aural rehabilitation can be provided in a variety of settings. In some instances, the character of apparently similar services may differ when they are delivered in different settings. In other instances they may be virtually identical. Reimbursement for services, however, depends heavily on the setting where they are provided (10).

Health Care Settings

Except for surgery, few hearing services are delivered in hospitals on an inpatient basis. This may become even more rare because of restrictions on admission and length of stay resulting from the Medicare prospective payment system. Diagnostic services are sometimes provided in hospitals, but aural rehabilitation services are seldom available (10).

Most hearing services provided by health care institutions are delivered on an outpatient basis, in either hospital-based or independent speech and hearing clinics. Diagnostic and rehabilitative services are usually provided, but the emphasis is on short-term care. Because of the relatively high overhead costs in most medically based outpatient facilities, long-term rehabilitative services in these settings are often prohibitively expensive. Occasionally, hearing services for older people are provided by local health departments and even mobile medical clinics.

Extended care facilities, such as nursing homes, would seem to be an optimal setting for the delivery of hearing services. Speech pathology services often are required as a condition of licensure for extended care facilities and speech pathologists sometimes refer elderly residents for hearing evaluations. However, comprehensive hearing services are seldom available in these facilities and it is often difficult for nursing home residents to go out to the offices of hearing specialists because of their other physical impairments. Some hearing aid dealers do visit nursing homes to evaluate patients and fit hearing aids, but few otolaryngologists and audiologists are available to treat residents in nursing homes.

Home health programs also offer an optimal setting to deliver hearing services, but unfortunately these services are rarely provided. In a study of 206 home health agencies, only 5 percent provided hearing services (72). Adult day care centers that serve people who require long-term care but can be maintained at home at night and on weekends are another possible setting for the delivery of hearing services to some older people (10). It is not known how many adult day care centers now provide hearing services.

Educational Settings

Hearing services are provided by some adult education agencies, community colleges, and university speech and hearing clinics. Adult education agencies first offered lipreading instruction for hearing impaired people during the 1920s and 1930s. Some of these programs have been expanded and now offer a comprehensive range of aural rehabilitation services (10).

During the past decade, several States have encouraged community colleges to initiate programs for disabled students. While some of these programs offer primarily vocation-oriented instruction to students, others offer comprehensive hearing services to adults of all ages (10).

University speech and hearing clinics are another source of hearing services and in some communities they are the major provider of services. These clinics are usually affiliated with the speech and hearing or audiology department of a university. This makes low-cost hearing services available since virtually all services are provided by students under careful supervision. However, this use of students gives an unrealistic impression about the true cost of hearing services (10). University speech and hearing clinics often provide a wider range of hearing services than other settings (115), including comprehensive evaluation, aural rehabilitation, and fitting for hearing aids. Some also supply assistive listening devices (140).

Community Agencies

Many communities offer hearing services in multi-service agencies. For example, senior centers generally provide recreation, education, counseling, and other social services for elderly people; some also offer hearing screening and other hearing services.[4] Some communities also have speech and hearing centers that offer a wide array of services including hearing aid dispensing. They may also sponsor satellite programs in other community agencies where older people are likely to be served (10).

ALTERNATE APPROACHES TO SERVICE DELIVERY

Alternate approaches exist that can help improve the delivery of hearing services. These include programs of the Veterans Administration, the elderhostel program of Gallaudet College, and assistive device centers. Self-help groups for hearing impaired people are also effective in educating people about hearing impairment, appropriate treatment, and methods for dealing with the fragmented delivery system. Two projects to provide hearing services for nursing home residents also have been developed and are described below.

Veterans Administration Hearing Services

The VA program of hearing services is one model of comprehensive service delivery. The VA program is an outgrowth of military aural rehabilitation centers established during World War II. At VA medical centers across the country, hearing services include: 1) evaluation by an audiologist; 2) evaluation by an otologist or otolaryngologist; 3) hearing aid dispensing; and 4) rehabilitation services such as speechreading, auditory training, and speech training to correct speech or voice problems associated with a hearing impairment (83).

Veterans with service-connected hearing impairments are eligible to receive all hearing services at no cost. Veterans who do not have service-connected hearing impairments but are over 65 or cannot afford hearing services are eligible for a free hearing test. Certain categories of veterans are also eligible for free hearing aids. These include veterans with service-connected hearing impairments, those who have 50 percent or more service-connected disability, those who are receiving home care benefits from the VA, prisoners of war, and World War I veterans. Other veterans are referred to hearing aid dealers or speech and hearing clinics to purchase a hearing aid. In fiscal year 1984, the VA distributed more than 36,000 hearing aids to eligible veterans (47). Large volume purchasing arrangements lower the cost of each aid, but it is difficult to compare the cost of aids distributed by the VA with the cost of aids distributed by other dispensers because the professional costs associated with testing hearing and selecting an aid are sometimes not included in the VA figures.

The VA model of service delivery has been adopted in other institutional settings where medical, audiologic, and hearing aid dispensing services are offered "under one roof." One such program is at the Albany Medical Center, where over the past 7 years more than 1,900 hearing impaired people of all ages have been treated. The program provides otolaryngologic, audiologic, and rehabilitative services, including evaluation for hearing aids, hearing aid dispensing, hearing aid orientation and counseling, speechreading, auditory training, and hearing aid repair (134). Similar programs have been developed by health maintenance organizations, particularly those that operate comprehensive medical centers (10).

The VA Medical Center in Birmingham, Alabama, has a program of service delivery that goes beyond what is provided in other VA medical centers. One of its primary objectives is the provision of comprehensive services and followup for veterans who have difficulty coming to the medical center.[5] VA staff point out that many people, not only veterans, live far from centers where comprehensive hearing services are provided and are unlikely to return for regular reevaluation, aural rehabilitation, and counseling. Even when long distances are not involved, lack of transportation and physical impairments that interfere with travel cause many people to drop out of treatment. Consequently, the Birmingham VA program provides many services by telephone.

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[4] A recent study of hearing services in senior centers, *Study of Programs and Services for the Hearing Impaired Elderly in Senior Centers and Clubs in the United States*, will be published by Gallaudet Research Institute in 1986 (100).

In this program, the initial evaluation and treatment are done in the hospital or the clinic, but after the initial treatment the clinic staff regularly initiate telephone contact with clients to review their progress, provide auditory training exercises and supplemental drills, and answer questions from the client or his family. Conference calls are used to conduct "group meetings" among individuals with similar impairments so they can give each other moral support and helpful hints about coping with mutual problems (130). This use of the telephone spares clients from repeated trips to the medical center. The alternative—sending staff members out to provide services away from the medical center—is prohibitively expensive.

The Birmingham VA program also emphasizes the use of assistive devices, both for telephone communication and for one-to-one and group listening. Many kinds of devices are given or loaned to clients. They encourage clients who wear hearing aids and those who do not to use assistive devices and have created a videotape explaining the kinds of assistive listening devices that are available.[6]

The Birmingham VA program also stresses training for hearing specialists and other health care and social service providers. VA staff have been involved in many conferences and training workshops across the country where they explain their method of telephone contacts for client education, reevaluation, and treatment, and educate providers about assistive listening devices, telecommunication devices, and signaling and alarm systems. They also provide telephone consultation to clinicians in VA and non-VA facilities.

A final component of the Birmingham VA program is REMATE, Remote Machine-Assisted Treatment and Evaluation. REMATE is a computer-based delivery system. The computer is programmed by the clinician to provide drill sessions by telephone for veterans nationwide and to store client responses for later review by the clinician. This system can also be used to gather and store data for long-term evaluation of treatment procedures (130).

Elderhostel Program for the Hearing Impaired

Another innovative approach to the delivery of hearing services is the elderhostel program conducted at Gallaudet College since 1981. Hearing impaired persons over 60 and their spouses or "significant others" are invited to the college in Washington, DC, for a week in the summer. They attend presentations about the nature of hearing loss and its impact on relationships, strategies for coping with hearing loss, and the roles of various hearing specialists. Lists of hearing specialists in the participants' home States are provided and assistive devices are on display. Participants also attend sessions on nonverbal communication and deaf culture. Participants have particularly appreciated the information on assistive devices and self-help techniques. Small group activities are also important; they allow hearing impaired elderly people to interact with others and realize they are not alone in coping with hearing loss. The originators of this elderhostel program believe it could be repeated at colleges and community agencies throughout the country (61).

Assistive Device Centers

Assistive device centers for the hearing impaired are locations where a variety of devices used to compensate for hearing loss are displayed and demonstrated. Hearing impaired people, their families, and health care and social service providers can visit these centers to learn about available devices. One assistive device center at the Fort Lauderdale Oral School is manned by volunteers from the Telephone Pioneers of America. Demonstration devices have been contributed by the manufacturers (34). Appendix B contains a list of assistive device centers in the United States. Centers are needed in other locations throughout the country.

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[5] These services are supported by the VA Exchange of Medical Information and Rehabilitation, Research, and Development Programs.

[6] The videotape was prepared by Gwenyth Vaughn and Robert Lightfoot for the Sertoma Foundation, with partial funding from Siemens Hearing Instruments, Inc.

Self-Help Groups for Hearing Impaired People

Self-help groups for hearing impaired people provide information for their members about devices and techniques that help compensate for hearing loss and about the role and expertise of different types of hearing specialists. The names of some of these groups are listed in appendix A. Some of them have assistive listening devices and telecommunication, signaling, and alarm devices available at their meetings so that attendees can try them. One self-help group, Self Help for Hard of Hearing People (SHHH), in cooperation with the Birmingham VA, has produced a series of six pamphlets on assistive listening devices and their uses.

Some self-help groups are primarily for deaf people, while others are primarily for hard-of-hearing people. Membership is open to people of all ages, but many members are elderly, particularly in the groups oriented to people with partial hearing loss. While younger people with hearing impairments and other handicaps have become increasingly assertive about the rights of the handicapped, many elderly people are still reluctant to call attention to their handicaps and to demand appropriate services. Self-help groups emphasize the rights of hearing impaired people and the rights of the consumer, an approach that may be particularly appropriate for elderly people (105).

The Suzanne Pathy Speak-Up Institute is a self-help group that focuses on improving communication between hearing impaired and normal hearing people. Members are encouraged to disclose their hearing loss and wear a symbol to indicate it. The organization provides information to community groups about how to communicate effectively with hearing impaired people.

Nursing Home Initiatives

Despite the high prevalence of hearing impairment in nursing homes and its often severe effects on residents' ability to interact with others, give and receive information, and adjust to the facility, little attention has been given to this problem. As one nursing home administrator pointed out: "To be perfectly frank, communication is at the bottom of my priorities. We care about nutrition, hygiene, medication; that's it" (14). Even when nursing home staff attempt to address the problems of hearing impairment among residents, few are knowledgeable about the devices and treatments available. Access to hearing services is often limited because some residents cannot pay for them and because it is difficult to take residents out to a specialist's office or get the specialist, particularly an otolaryngologist or audiologist, to come to the nursing home. As a result, many people who might benefit from hearing services and devices do not receive them.

The Nursing Home Ombudsman Program of Monroe County, New York, is an example of one approach developed to help solve this problem.[7] Beginning in 1981, as a result of the effort of one ombudsman volunteer, the program has provided sensitivity training for all ombudsman volunteers to increase their understanding of the impact of hearing impairment on residents. The volunteers are taught how to communicate with hard-of-hearing and deaf people. They are trained to be aware of residents whose hearing aids are not working properly or who may need new batteries. The Ombudsman Program has also provided workshops for nursing home staff to increase their understanding of hearing impairment, hearing aids, and other devices that can benefit residents. The success of these approaches in nursing homes has prompted a recent expansion of the program into local hospitals (14).

A second program initiative for nursing home residents is being developed by SHHH and the American College of Health Care Administrators (ACHCA). In the first stage of this program, SHHH will train volunteers to help residents better use their hearing aids by teaching them to insert and remove the aids, encouraging regular use, and assisting with cleaning and battery replacement. ACHCA will notify nursing home administrators of the availability of the program and provide SHHH with the names of interested administrators (4).

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[7] The Federal Government provides funds to each State to develop and run a nursing home ombudsman program. Design of the program is up to the State and some States have contracted with local agencies to implement the program.

SCREENING PROGRAMS

Screening programs are an important method of identifying people who have hearing impairments and need treatment. The goal of these programs is to identify all those who need further evaluation, but hearing specialists continue to debate the best methods for doing this. As discussed in chapter 2, interview methods fail to identify some people with hearing impairments because the people are unaware of their hearing loss or deny it to the interviewer. This may be particularly true in some minority groups. Pure tone air and bone conduction tests miss individuals who can hear pure tones but have difficulty with auditory discrimination. Since this is frequently a problem among elderly people, speech reception and speech discrimination tests are an important element of an effective screening program for them. In addition, elderly people often have particular difficulty with background noise and some measure of hearing in a noisy environment is needed (54).

Ventry and Weinstein (131) have developed a screening program for elderly people that includes both audiometric tests and a self-assessment instrument to identify the social and emotional effects of hearing loss. The self-assessment instrument is the first designed for and standardized on elderly people. Further testing of this screening program is being funded by the National Institute on Aging (59).

Some elderly people who are very withdrawn and apparently cognitively impaired do not respond to the usual audiometric tests and self-assessment instruments. A technique that has been used with very young children can also be used to measure the hearing of these people. This technique measures brain wave response to sound, or *auditory evoked potential*, and does not require active cooperation from the person being tested. A hearing aid can be put on the person to determine whether amplification increases the brain wave response. Finding hearing loss in a very withdrawn person does not necessarily mean that a hearing aid or other treatment will be effective because the patient may be too cognitively impaired to benefit from the device (140). Nevertheless, the availability of a technique to measure hearing in these patients is important for diagnostic purposes.

REGULATION OF THE DELIVERY SYSTEM

Federal legislation and regulations affect the delivery of hearing services both directly, through FDA regulations on hearing aids, and indirectly, through Medicare and Medicaid regulations on reimbursement for hearing services. Medicare and Medicaid are discussed in chapter 5. This section reviews FDA regulations. The Federal Trade Commission (FTC) recently decided against industrywide regulation of various aspects of hearing aid sales, and the history of this decision is also discussed briefly.

Federal investigation of hearing aid sales practices began in the 1960s. Early efforts led by Senators Kefauver and Church resulted in news releases and other reports that alerted the public to widespread problems but did little to prevent or control them. During the mid-1970s, the FTC initiated a major effort to develop regulations for hearing aid sales. The results of their investigations and recommended regulations were published in 1978. The recommended regulations would have restricted advertising, in-home sales, marketing of used hearing aids, and the use of screening programs to identify potential customers. The most important and most vigorously contested recommendation was a provision to allow a hearing aid purchaser or renter to cancel the sale or rental within 30 days and receive a refund (10, 77).

Hearings were held in 1978 and FTC staff recommended issuance of the regulations after reviewing the "compelling testimony (about) the numerous experiences reported of unusable hearing aids, purchased at great financial sacrifice, and of a multitude of abusive sales transactions and sales tactics" (48). However, the Commission did not rule on the staff recommendations at that time.

In 1985, with the regulatory procedure still pending, the FTC contracted for a survey of hearing aid users to determine whether regulation of hearing aid sales was needed. The results of the survey, many of which have been reported in this OTA background paper, convinced FTC staff and commissioners that no industrywide regulation is needed (86). The regulatory procedure subsequently has been dropped.

Regarding the 30-day trial period, the survey indicated that 64 percent of the respondents purchased hearing aids with a trial period, 16 percent could not remember whether a trial period was available, and 20 percent purchased aids for which a trial period was not available. Some States require a trial period, while others do not.[8] However, the survey showed that people who purchased hearing aids in States that require a trial period were no more likely to be offered a trial period than people who purchased aids in States that do not require a trial period (75).

The FTC concluded from these data that trial periods are widely available and that State laws requiring trial periods may not increase their availability (86). A staff memo to the FTC Commissioners concluded: "Market forces appear to have been as effective as legal requirements in promoting the proliferation of trial periods" (86).

The FTC's reliance on these survey findings has been criticized because the sampling procedures used produced very few respondents in the States that require a trial period. Thus, the difference in availability of trial periods in States that require a trial period and those that do not could have occurred by chance (107). In addition, although the survey indicates that almost two-thirds of those who purchased hearing aids were offered trial periods, at least 20 percent purchased aids for which a trial period was not available. To hearing specialists and consumer advocates who believe that the availability of a trial period is important, these figures are not reassuring.

ASHA and the American Association of Retired Persons (AARP) submitted testimony opposing the FTC decision to drop the regulatory procedure. They cited experiences of their members that support continuing need for regulation of the hearing aid industry. AARP testimony emphasized the need for an FTC-sponsored consumer education program to inform the public about hearing impairment, hearing specialists, and devices to compensate for hearing loss (3).

In the mid-1970s, almost simultaneously with the initial FTC efforts, FDA began to develop regulations for hearing aids under its mandate to regulate medical devices. The purpose of the FDA effort was quite different from that of FTC. FDA was concerned about the "safety and effectiveness" of hearing aids as medical devices, not with sales practices per se. The proposed FDA regulations were much less restrictive than the FTC regulations, met with less opposition, and were adopted in 1977. The FDA regulations were at odds with the laws and regulations of several States, and those States applied for exemption from the new Federal rules. In virtually all instances the State regulations were more restrictive than the new FDA regulations. FDA reviewed these applications and granted some exemptions but most were denied (10).

The FDA hearing aid regulations relate primarily to labeling and conditions of sale. Labeling requirements specify that the hearing aid must show the name of the manufacturer or distributor, the model name or number, serial number, year of manufacture, and an indication of the correct battery position. The requirements also specify essential information that must be contained in an instructional brochure to illustrate and describe the operation, use, and care of the aid; sources of repair and maintenance; and a statement to the effect that the use of a hearing aid may be only part of a rehabilitative program that may also involve speechreading or auditory training. This brochure must be provided with the aid. The regulations also require a warning to dispensers and purchasers that certain conditions make medical consultation advisable prior to purchase of an aid. The warning to dispensers also advises caution when fitting the more powerful hearing aids.

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[8] Connecticut, Maine, New Hampshire, New York, Oregon, Texas, Vermont, and the District of Columbia require a trial period. California, Kentucky, North Carolina, Tennessee, and Washington have laws or regulations that require a trial period under some circumstances. Other States have no requirement for a trial period (75).

As discussed earlier, FDA requires that the consumer provide the hearing aid dealer or dispenser evidence of a physician's evaluation or sign a waiver of this requirement before purchasing a hearing aid. Although there is no information about the number of aids that are sold on the basis of waivers, some hearing specialists believe that the number is high and that the use of waivers undermines the basic purpose of the FDA regulations. In 1980, ASHA testified to this effect before the Senate Subcommittee on the Handicapped:

> Under the FDA's regulation, hearing aids can and are being sold to persons without either a medical examination or a test of their hearing. This is leaving the hard-of-hearing, especially the elderly, vulnerable to the pressures of hearing aid salesmen. Without testing, it is impossible to know the type, nature, and degree of loss or even whether a hearing aid is necessary or will be beneficial. Without requiring a hearing test, State consumer protection officials or private parties lack the fundamental evidence to prove whether or not a hearing aid was appropriately sold . . . The FDA's regulation, its preemption of State laws providing greater protection to consumers and its pressure on other agencies to follow its suit has been a *major setback* in providing quality care to the hearing impaired, especially the elderly (6).

Other hearing specialists disagree and argue that the FDA regulations are fulfilling their intent (133).

Assistive listening devices are generally not regulated by FDA. Hearing specialists are concerned about the need to protect consumers from devices that may be useless or harmful. At the same time, many hearing specialists do not favor FDA regulation of these devices because FDA rules about the distribution of medical devices affect how devices can be marketed and could ultimately raise costs and limit use (33).

In addition to FTC and FDA regulations, the delivery of hearing services to elderly people is affected by Medicare and Medicaid regulations that control reimbursement. In many instances, these regulations determine point of entry, who may provide services, the services that may be delivered, the setting in which the services are provided, and the way in which the services are offered. These programs are discussed in the next chapter.

Chapter 5

Funding for Treatment of Hearing Impairments

Chapter 5

Funding for Treatment of Hearing Impairments

Hearing services and devices are paid for directly by hearing impaired people or by private insurance and government programs such as Medicare, Medicaid, and the Veterans Administration (VA).[1] In general, medical and surgical hearing services provided by physicians are covered by Medicare, Medicaid, and private insurance. Some services provided by audiologists are also covered, especially when authorized by a physician, but evaluations for hearing aids are usually not covered. Hearing aids and assistive listening devices are not covered by Medicare and are rarely covered by private insurance. Medicaid pays for hearing aids in about half the States, but only a small percentage of the elderly population is eligible for these services. Only about 15 percent of hearing aids are paid for wholly or in part by any third-party payer, including Medicaid, the VA, and private insurance (75).

The pattern of funding for hearing services reflects an underlying philosophy of government and private insurance programs that emphasizes the importance of physician care and medical and surgical treatment, while deemphasizing rehabilitative approaches such as providing assistive devices to help people function despite impairments. This philosophy is also evident in Medicare and Medicaid regulations and private insurance policies that limit reimbursement for devices and rehabilitation services related to impairments in vision and speech.

Hearing aids are the most common form of treatment for hearing impairment in elderly people, and it is often alleged that the cost of hearing aids severely restricts their use. One report points out, however, that the cost of hearing aids has risen very little in the past 25 years (41). From 1960 to 1980, while the Consumer Price Index increased more than 300 percent, the average cost of a hearing aid increased from about $350 to $450, or less than 25 percent. Sales expansion, improved manufacturing techniques, and changes in marketing have led to this relative price stability despite inflation in the economy as a whole. While the cost of a hearing aid is still too high for some low-income people, many people can afford them. In fact, the number of individuals buying hearing aids increased significantly between 1980 and 1983 despite a 25 percent decrease in third-party reimbursement (24).

Since government programs and private insurance usually do not pay for hearing aids, hearing impaired people often have to pay for these devices themselves. While many elderly people do purchase hearing aids, few are also willing and able to pay for a comprehensive audiological evaluation to help them select the hearing aid or aural rehabilitation services to help them adjust to it (138).

Assistive listening devices are not covered by Medicare, Medicaid, or private insurance. Legislation has been introduced in Congress to allow reimbursement for these devices under Medicare and Medicaid. The Handicapped Assistance Act of 1985 (H.R. 1432) would amend the Social Security Act to allow payment for sensory and communication aids for persons with visual, speech, and hearing impairments. Reimbursement would be limited to $5,000 a year and no more than $15,000 in any 5-year period (17).

Allowing tax credits for the purchase of assistive listening devices is another approach to encourage their use. This idea is not now politically viable because Congress and the Administration oppose creating new tax deductions and tax credits (56).

Aural rehabilitation services are covered by Medicare, Medicaid, and some private insurance in certain circumstances, but these services are seldom received by elderly people, as discussed in chapter 3. Government initiatives to increase the use of these services could include increased funding and/or simplification of the complex requirements for reimbursement for these services under Medicare and Medicaid. Increased public education about the potential benefit of aural rehabilitation for elderly people could encourage individuals to pay for these services themselves.

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[1] Hearing services provided and paid for by the Veterans Administration were discussed in ch. 4

MEDICARE

Almost all Americans over 65 are covered by Medicare, the health insurance program authorized by Title XVIII of the Social Security Act to provide payment for specified health services. Under Part A Hospital Insurance, Medicare pays for hospital care, some posthospital extended care, and home health services. Under Part B Supplemental Medical Insurance Benefits, Medicare pays for physicians' services, hospital outpatient services, diagnostic laboratory tests, some durable medical supplies, and services such as physical therapy and speech therapy when authorized by a physician (10).

Most physician services related to the diagnosis and treatment of hearing impairment are covered by Medicare. Some hearing services provided by an audiologist are reimbursable under certain circumstances. For example, an audiological evaluation requested by a physician to help diagnose hearing disorders is reimbursable. Rehabilitative services provided by an audiologist are covered for some patients, but complex regulations, summarized below, govern which audiology services are covered, and in which settings (10).

Under Medicare Part A, rehabilitative audiology services requested by a physician and directly related to the condition for which a patient is hospitalized can be provided for hospital inpatients and residents of skilled nursing facilities (SNF). Diagnostic and therapeutic audiology services requested by a physician can be covered for hospital inpatients when provided by an audiologist who is either an employee of the hospital or who has made a contractual arrangement with the hospital. An audiologist who is employed by the hospital can also provide audiology services for patients transferred to a SNF if the SNF and the hospital have a transfer agreement (10).

Under Medicare Part B, an audiological evaluation requested by a physician for diagnostic purposes is reimbursable. Other hearing services provided by an audiologist also can be reimbursed under Part B: 1) if the audiologist is employed by a physician or in a physician-directed clinic, 2) if the physician is on the premises and supervises the services, and 3) if the audiological services are an integral part of the physician's professional services. Diagnostic and therapeutic services provided by audiologists also can be reimbursed as a Part B benefit for audiologists employed in a rehabilitation agency, skilled nursing facility, hospital outpatient clinic, or home health agency (10).

Hearing services provided by hearing aid dealers are not reimbursed by Medicare. Medicare does not pay for hearing evaluations performed to help select a hearing aid and it does not pay for hearing aids or other assistive listening devices.

MEDICAID

Medicaid is a joint Federal/State program, authorized by Title XIX of the Social Security Act to provide funding for health care services for the poor. Elderly individuals with income and assets below established levels are eligible for Medicaid. People with income above these levels but with high medical expenses are also eligible in some States.

The Federal Government requires that State Medicaid programs cover certain health care services, while other services are optional. States are required to cover:

- Hearing services provided by hospitals to inpatients or outpatients. These services can include audiology services prescribed by a phy-

sician with a physician's recertification of the need for continuing treatment every 30 days.
- Hearing services provided in SNFs by a physician or an audiologist working under the direction of a physician.
- Hearing services provided by physicians in the community.
- Some hearing services provided by audiologists in the community. These services must be provided under the personal supervision of a physician. States are free to define the degree of personal supervision required, but many adopt the definition used by the Medicare program—that the audiologist must be employed by a physician (or group of physicians) and practice in the same office or clinic as the physician (10).

States are not required to reimburse any other hearing services under Medicaid, but Federal matching funds are available to States for a wide variety of optional services including diagnosis, screening, rehabilitative services, and hearing aids. Most States limit the optional Medicaid services they provide in order to control overall costs of the Medicaid program. A 1979 survey of Medicaid programs in 49 States[2] and the District of Columbia conducted by the American Speech-Language-Hearing Association (ASHA) revealed the following about States' coverage of hearing services beyond the mandatory benefits:

- Twenty-nine States covered evaluative and diagnostic services provided by ASHA-certified or licensed audiologists regardless of the setting, but in seven of these States coverage was limited to children. Only 7 of the 29 States covered aural rehabilitation services for adults. Fifteen additional States covered audiology services only when provided in specific facilities or agencies, such as rehabilitation centers and home health agencies. The remaining States only covered hearing services provided by physicians.
- Prior authorization by the State Medicaid agency was required for aural rehabilitation services in all cases, but was seldom required for diagnostic services. Referral from a physician was generally required for all services.
- Twenty-eight States provided reimbursement for hearing aids for eligible adults. Prior authorization was required in nearly all States. Other requirements for reimbursement of aids varied: evaluations by audiologists or through speech and hearing centers approved by the State were mandatory in 36 States; 10 of these permitted evaluation by an otolaryngologist in lieu of an audiologist, while 14 required a physician's examination in addition to the audiologist's evaluation (7).

As a result of Medicaid cutbacks since 1979, fewer States probably pay for hearing services now. Moreover, even in those States that pay for aural rehabilitation services and hearing aids through Medicaid, the reimbursement rates are often so low that providers refuse to serve Medicaid patients.

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[2] Arizona did not participate in the Medicaid program at the time of the survey.

OTHER GOVERNMENT FUNDING PROGRAMS

Funding for hearing services is available to some elderly veterans and retired military personnel through VA and military hospitals. Some elderly individuals are also served in programs sponsored by the Bureau of Indian Affairs and the Federal Bureau for Community Health Services.

State Vocational Rehabilitation Agencies provide a wide range of services to handicapped individuals, including hearing impaired people. These services can include counseling, hearing aids and other devices, and aural rehabilitation. However, only about 2 percent of all people receiving any services from State Vocational Rehabilitation Agencies are over 65 (13). No figures are available on the number of elderly individuals who receive hearing services.

Federal funds for the elderly are available to States through the Title XX Block Grant, the Community Development Block Grant, and Title III of the Older Americans Act. Some States use some of these funds to provide hearing services, but these programs are very limited and the demand for services always exceeds available funds. For example, in 1984 Montgomery County, Maryland initiated a program to buy or lend assistive devices of all kinds using Community Development Block Grant funds. About 90 percent of the funds were spent for hearing aids for people of all ages and the demand for hearing aids was so great that the program ran out of money in 3 months (46).

PRIVATE INSURANCE

The private health insurance industry consists of three major components: 1) the nonprofit Blue Cross and Blue Shield plans that enroll 38 percent of the privately insured population; 2) commercial insurance companies that provide coverage to 54 percent of the privately insured population; and 3) independent prepaid and self-insured health plans including large prepaid group practice plans such as the Kaiser Foundation plans and health plans operated jointly by union and management in some industries. These prepaid plans cover only about 7 percent of the insured population, but they are more likely than other insurers to offer a comprehensive array of outpatient and preventive services (10).

Private insurance coverage of hearing services is important for elderly people because Medicare covers only part of the health care expenses of elderly people, currently less than 50 percent. Many older people purchase supplemental insurance from private insurers. In addition, a small segment of the elderly population is not eligible for or not enrolled in Medicare and many of these people have private insurance (10).

Determining whether an insurer will reimburse for hearing services is not simple. Each insurance policy is independently negotiated, so that a single company may issue policies with many variations in the provisions affecting hearing services. In fact, few policies directly address hearing services; instead, coverage is determined by the provisions for broad categories of services such as "miscellaneous medical," "physiotherapy," or "other medically necessary services." Whether hearing services are reimbursable depends on if a given service meets the general conditions in these broad categories (10).

The principal variables that affect coverage are:

- In what setting is the service provided? (Hospital inpatient unit, hospital outpatient department, physician's office, audiologist's office, hearing aid dealer's office, speech and hearing clinic?)
- Who is providing the service? (A physician, a licensed or ASHA certified audiologist, a hearing aid dealer?)
- What kind of service is provided? (Diagnosis, evaluation for a hearing aid, aural rehabilitation?)
- Why is the service needed? (Injury, illness, congenital or acquired disease, organic or nonorganic disorder?)
- What is the role of the beneficiary's physician? (Prescription, supervision, referral?)

Because conditions in the policies of private insurers vary so greatly, it is not possible to document exactly which hearing services are covered by which insurers for which groups of beneficiaries. However, some general statements can be made about predominant patterns and limitations of coverage.[3]

Where Services Are Provided and By Whom

Health insurance primarily covers the cost of hospitalization and physicians' services and most policies reimburse for hearing services provided by physicians in hospitals and in the community. In addition, certain hearing services are covered when provided by a qualified practitioner. In one survey, a licensed audiologist was deemed qualified by nine companies and six companies accepted ASHA certification in lieu of licensure (7). Four insurers left the choice of a qualified practitioner up to the physician prescribing and supervising the services. Blue Cross/Blue Shield plans tend to be less flexible about whom they will reimburse. A study of all 70 Blue Shield plans nationally reported that only 9 would reimburse for covered services provided by audiologists (78).

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[3] This information is derived from three sources: 1) collection of various existing surveys undertaken by ASHA members and others of major insurers doing business in their areas (5, 16, 20, 40); 2) a survey conducted by ASHA's Task Force on Private Insurance of 15 major national insurers (7); and 3) a study conducted by the Blue Cross Association of Blue Shield plan reimbursement of nonphysician providers (78).

Type and Purpose of Services

Nearly all policies specify that they cover only "medically necessary" services, but none defines the term. In effect, a service is medically necessary when a physician says it is and the insurer agrees. This requirement mandates the involvement of physicians for all reimbursable services (10).

Coverage of specific hearing services by the companies surveyed was virtually uniform. Audiologic testing needed by a physician to establish a diagnosis was covered in all cases. *Routine evaluations to detect hearing loss and services related to degenerative hearing loss were never covered.* Several companies would cover audiologic services and hearing aids when a hearing loss resulted from an accident or injury, but *most policies specifically exclude hearing aid evaluations and hearing aids.* A survey by Hewitt Associates, a nationwide consulting firm specializing in employee benefits and compensation, found that only 6 percent of U.S. firms offer hearing-care plans (28). The United Automobile Workers Union has recently negotiated the first major labor contract to include coverage of hearing aids (104).

Hearing services provided to maintain rather than improve hearing are generally excluded. If a beneficiary had a communicative handicap before an injury or illness that is covered by a policy, then hearing services would be covered only to the extent that they were needed to restore the beneficiary to his or her previous level of functioning.

Role of the Physician

Physicians must be involved in health insurance claims for hearing services at least enough to document "medical necessity" to the insurer. Physician referral and supervision is the most common requirement. Supervision generally means that the physician must cosign claims and accept responsibility for the services (10).

Among the insurers surveyed by ASHA, six required only physician referral for hearing services. Two required physician approval of such services, while three required physician supervision (7). Two companies did not specify the role of the physician, while one required physician direction of diagnostic audiologic services. The distinctions between "approval," "recommendation," and "supervision" are fuzzy, but the insurers' intent in all cases is to ensure that a physician's statement of the initial and continuing need for services is submitted before claims will be paid.

Thus private insurance coverage of hearing services appears to mirror Medicare and Medicaid coverage, allowing reimbursement for medical and surgical services and for services provided by physicians for medical problems. In contrast, rehabilitative services, and particularly the cost of hearing aids and assistive listening devices, are not covered. Thus elderly people must pay for these services and devices themselves or do without.

Chapter 6

Conclusion

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Conclusion

This background paper has discussed the types of hearing impairment that are most common among elderly people, hearing devices and services that may benefit them, and aspects of the delivery system and third-party reimbursement that limit use of these devices and services. Federal policy options have not been analyzed. However, some of the findings of this paper are relevant to the development and analysis of Federal legislative and regulatory policies. These are listed below:

- Hearing impairment is very common among elderly people and can seriously affect their safety, quality of life, and ability to live independently.
- Most research on hearing impairment has focused on very severe impairments, deafness, and the hearing impairments of young people, rather than the moderate or partial hearing impairments that are common among elderly people. As a result, many questions about the pathology of hearing loss in elderly people remain unanswered. The term presbycusis is used to refer to hearing loss associated with aging, but there is disagreement about the term's meaning. In addition, the causes of presbycusis are not well understood.
- Most research on treatment for hearing impairment has focused on medical and surgical treatments rather than rehabilitative approaches. Yet the latter are generally more effective for the types of hearing impairment common among elderly people. Rehabilitative approaches such as the use of hearing aids, assistive listening devices, and aural rehabilitation services can improve a person's ability to communicate even when the underlying cause of the hearing impairment cannot be cured.
- Third-party reimbursement, including Medicare and Medicaid, is available for medical and surgical treatment but usually is not available for hearing aids, assistive listening devices, and some aural rehabilitation services. Thus, these reimbursement programs fail to fund the treatments that are most effective for elderly people.
- Many people, including the elderly, their families, health care and social service professionals, and others, are not aware of the prevalence of hearing impairment among elderly people; its physical, emotional, and social impact; and the hearing devices and services that can compensate for it. Public education to increase awareness of this problem and training for health care and social service professionals are needed.
- Negative attitudes about aging and the rehabilitation potential of elderly people discourage the use of potentially effective treatments. Public education programs could be designed to counteract these negative attitudes. In addition, they could emphasize that communication is a two-way process, involving both the speaker and the listener. Some of the simplest methods for facilitating hearing, such as the rules for speaking to someone with a hearing loss, require active cooperation by the speaker. Public education programs could emphasize the role of the speaker in facilitating effective communication with hearing impaired people.
- Hearing aids have been helpful for many hearing impaired people, but most hearing impaired people do not buy a hearing aid and some who buy an aid do not use it. Factors that interfere with increased use of hearing aids include problems in the design or function of the aid; problems in selecting an appropriate aid for the individual; inability of the individual to adjust to the aid; and disagreement among hearing specialists about who can benefit from a hearing aid. The frequency with which each of these problems occurs is not known. Developing solutions for them is a potential area for cooperative research by the hearing aid industry and hearing specialists (physicians, audiologists, and hearing aid dealers).
- Assistive listening devices can be particularly beneficial for hearing impaired elderly people because they lessen the impact of background noise, a major problem for many el-

derly people. These devices can be used in public meeting rooms and for interpersonal communication in doctors' offices, hospitals, and nursing homes, and in a variety of social and recreational listening situations. Yet these devices are not widely used. Increasing their use will require recognition of their potential value by hearing specialists (physicians, audiologists, and hearing aid dealers) and efforts by these specialists to promote them.

- Use of the telephone is particularly important for elderly people who live alone and those who have difficulty getting out because of physical impairments. Federal legislation and regulations that affect the availability of telephones compatible with hearing aids and telephone amplification devices for home use should acknowledge the important role the telephone plays in maintaining the safety, independence, and quality of life of hearing impaired elderly people.
- Much is known about environmental design techniques that can reduce reverberations and background noise and thus facilitate hearing. However, this knowledge has not been widely applied. Building design regulations for long-term care facilities and housing for the elderly could incorporate these design techniques.
- Aural rehabilitation services such as hearing aid orientation, auditory training, speechreading, and counseling are frequently not available to elderly people with hearing impairments despite their potential benefit.
- The existing service delivery system is fragmented and does not provide optimal hearing services for elderly people. Rivalry among the three types of hearing specialists—physicians who specialize in hearing disorders, audiologists, and hearing aid dealers—contributes to the fragmentation of the delivery system. Any Federal legislation or regulations related to hearing services could be designed to encourage the development of coordinated service delivery systems.
- In some instances, an educated consumer is the best protection against deficiencies in the service delivery system. Self-help groups may be the most effective method for educating consumers.
- Although almost half of all hearing impaired people are over 65, the training of hearing specialists generally has not emphasized the types of hearing impairments that are common among elderly people and the most appropriate treatments for them. Each type of hearing specialist needs training in these areas.
- The impact of hearing impairment on elderly people in hospitals and nursing homes can be particularly severe, limiting their ability to communicate with doctors, nurses, and other personnel, understand their medical treatment, and understand and adjust to facility routines. Federal and State regulations govern many aspects of patient care in hospitals and nursing homes, but few regulations apply to the provision of hearing devices and services for hearing impaired patients.

While hearing impairment is a serious problem among elderly people in this country, partial solutions are available. We now have an increased understanding of the problem and various devices and services are available. Federal initiatives in the areas of research, public education, and improvements in the service delivery system could help solve the problems faced by hearing impaired elderly people and could significantly improve the quality of their lives.

Appendixes

Appendix A

Information Sources

Alexander Graham Bell Association for the Deaf
3417 Volta Place, N.W.
Washington, DC 20007
(202) 337-5220

American Academy of Otolaryngology—Head and Neck Surgery
1101 Vermont Avenue, N.W., Suite 302
Washington, DC 20005
(202) 289-4607

American Speech-Language-Hearing Association
10801 Rockville Pike
Rockville, MD 20852
(202) 897-5700

American Tinnitus Association
P.O. Box 5
Portland, OR 97207
(503) 666-2625

AT&T National Special Needs Center
2001 Route 46
Parsippany, NJ 07054
1-800-233-1222

Audiology—Speech Pathology Service
Birmingham VA Medical Center
700 South 19th Street
Birmingham, AL 35233
(205) 933-8101, ext. 6702

Better Hearing Institute
1430 K Street, N.W.
Suite 600
Washington, DC 20005
(202) 638-7577

Consumers Organization for the Hearing Impaired, Inc. (COHI)
P.O. Box 8188
Silver Spring, MD 20910
(301) 587-2514

Hear-Say
2525 Murworth, Suite 207
Houston, TX 77054
(713) 666-2625

International Federation of the Hard of Hearing
Pirol Kamp D-2000
Hamberg 65, German Federal Republic

National Association for Hearing and Speech Action
10801 Rockville Pike
Rockville, MD 20852
1-800-638-8255

National Association of the Deaf
814 Thayer Avenue
Silver Spring, MD 20910
(301) 587-1788

National Captioning Institute
5203 Leesburg Pike
Falls Church, VA 22041
(703) 998-2400

National Center for Law and the Deaf
Gallaudet College
800 Florida Avenue, N.E.
Washington, DC 20002
(202) 651-5454

National Hearing Aid Society
20361 Middlebelt Road
Livonia, MI 48152
(313) 478-2610

National Information Center on Deafness
Gallaudet College
800 Florida Avenue, N.E.
Washington, DC 20002
(202) 651-5109

National Technical Institute for the Deaf (NTID)
One Lomb Memorial Drive
P.O. Box 9887
Rochester, NY 14623
(716) 475-6400

Office of Cued Speech Programs
Gallaudet College
800 Florida Avenue, N.E.
Washington, DC 20002
(202) 651-5527

Organization for the Use of the Telephone
(OUT)
P.O. Box 175
Owings Mills, MD 21117
(301) 655-1827

Self Help for Hard of Hearing People, Inc.
(SHHH)
7800 Wisconsin Avenue
Bethesda, MD 20814
(301) 657-2248

Suzanne Pathy Speak-Up Institute, Inc.
525 Park Avenue
New York, NY 10021
(212) 832-8286

Telecommunications for the Deaf, Inc.
814 Thayer Avenue
Silver Spring, MD 20910
(301) 587-1788

Appendix B

Assistive Device Centers

Assistive device centers are locations where a variety of devices to compensate for hearing impairment are displayed and demonstrated. The centers are open to the public, and some centers sell as well as demonstrate devices. This list of assistive device centers was adapted from information provided to OTA by George W. Fellendorf, Fellendorf Associates, Inc. In addition to the centers listed here, many hearing specialists display and sell some devices.

ARIZONA

Heidico, Inc.
444 South Montezuma Street
Prescott, AZ 86301
(602) 445-9554 (V) (TDD)
Contact: Remi Saffran

Tucson Hearing Society
c/o University of Arizona
Department of Speech and Hearing
Tucson, AZ 85721
(602) 621-7070
Contact: Anne Lanshe or William Hodgson

CALIFORNIA

Hearing Society for the Bay Area
1428 Bush Street
San Francisco, CA 94109
(415) 775-5700 (V); (415) 776-3323 (TDD)
Contact: John L. Darby or Michael V. Sisk

H.E.A.R. Center
Providence Speech and Hearing
1301 Providence Avenue
Orange, CA 92668
(714) 639-4990 (V); (714) 639-1393 (TDD)
Contact: Donna Greenfield

House Ear Institute
256 South Lake Street
Los Angeles, CA 90057
(213) 483-4431 (V); (213) 484-4642 (TDD)
Contact: Linda K. Dye

COLORADO

Harvard Park Hearing Center
950 East Harvard Avenue
Suite 500
Denver, CO 80210
(303) 777-4327 (V and TDD)
Contact: Bruce D. Schachterle

The Hearing Store
2308 South Colorado Boulevard
Denver, CO 80222
(303) 757-4327 (V); (303) 757-4715 (TDD)
Contact: Bruce D. Schachterle

DISTRICT OF COLUMBIA

Gallaudet College
Assistive Devices Center
Department of Audiology
800 Florida Avenue, NE
Washington, DC 20002
(202) 651-5328 (V and TDD)
Contact: Cynthia Compton Fernandes

FLORIDA

Fort Lauderdale Oral School of Nova University
3375 W. 75th Avenue
Fort Lauderdale, FL 33314
(305) 475-7324
Contact: Joan Rollins-Bellows or Jack Mills

ILLINOIS

Chicago Hearing Society
Charles Silberman Center for Assistive Devices
10 West Jackson Boulevard
Chicago, IL 60604
(312) 939-6888 (V); (312) 427-2166 (TDD)
Contact: Daria Popowych

Sound Resources, Inc.
201 East Ogden
Hinsdale, IL 60521
(312) 323-7970 (V and TDD)
Contact: Barbara Carlson

INDIANA

Purdue Audiology Clinic
Heavilon Hall, Purdue University
West Lafayette, IN 47907
(317) 494-3789
Contact: Carl A. Binnie

KANSAS

Institute of Logopedics
2400 Jardine Drive
Wichita, KS 67219
(316) 262-8271 (V and TDD)
Contact: Karen Black Kramer

MARYLAND

Assistive Devices Center
Consumers Organization for the Hearing Impaired, Inc. and The National Association of the Deaf
814 Thayer Avenue
Silver Spring, MD 20910
(301) 587-2514 (V); (301) 946-0037 (TDD)
Contact: Gary Olson or Will Gross (V) Bill Paschell (TDD)

Hearing and Speech Agency of Metro Baltimore, Inc.
2220 St. Paul Street
Baltimore, MD 21218
(301) 243-3800 (V); (301) 243-1274 (TDD)
Contact: Clifford Lull

Self Help for Hard of Hearing People
7800 Wisconsin Avenue
Bethesda, MD 20814
(301) 657-2248 (V); (301) 657-2249(TDD)
Contact: Howard (Rocky) Stone or Charles Mizell

NEW YORK

Burke Rehabilitation Center
Department of Speech, Language and Audiology
785 Mamaroneck Avenue
White Plains, NY 10605
(914) 948-0050, extension 2306
Contact: Rochelle Shotland

Hearing Rehabilitation Center
Albany Medical Center Hospital
New Scotland Avenue
Albany, NY 12208
(518) 445-4535 (V and TDD)
Contact: Donna S. Wayner

Mill Neck Foundation
P.O. Box 100
Mill Neck, Long Island, NY 11765
(516) 922-3880 (V and TDD)
Contact: Louis Frillman

National Technical Institute for the Deaf
One Lomb Memorial Drive
Rochester, NY 14623
(716) 475-6473 Kathy Tyson
(716) 475-6476 Diane Castle

New York League for the Hard of Hearing
71 West 23d Street
New York, NY 10010
(212) 741-7650 (V); (212) 255-1932 (TDD)
Contact: Joshua M. Gendel

Park East Hearing Center
1641 East Avenue
Rochester, NY 14610
(716) 461-9192 (V); (716) 461-0357 (TDD)
Contact: Sheila Dalzell

OKLAHOMA

HearCare
Medical Park Center
Suite 601
Bartlesville, OK 74006
(918) 333-8910 (V and TDD)
Contact: Carolyn Kisler

OREGON

Eugene Hearing and Speech Center
1202 Almaden Street
P.O. Box 2087
Eugene, OR 97402
(503) 485-8521 (V and TDD)
Contact: R. Craig Ford

TENNESSEE

Bill Wilkerson Hearing and Speech Center
1114 19th Avenue South
Nashville, 37212
(615) 320-5353 (V)
Contact: Judy Ventress

TEXAS

Callier Center for Communication Disorders
University of Texas at Dallas
1966 Inwood Road
Dallas, TX 72535
(214) 783-3000 (V and TDD)
Contact: Carolyn R. Musket

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